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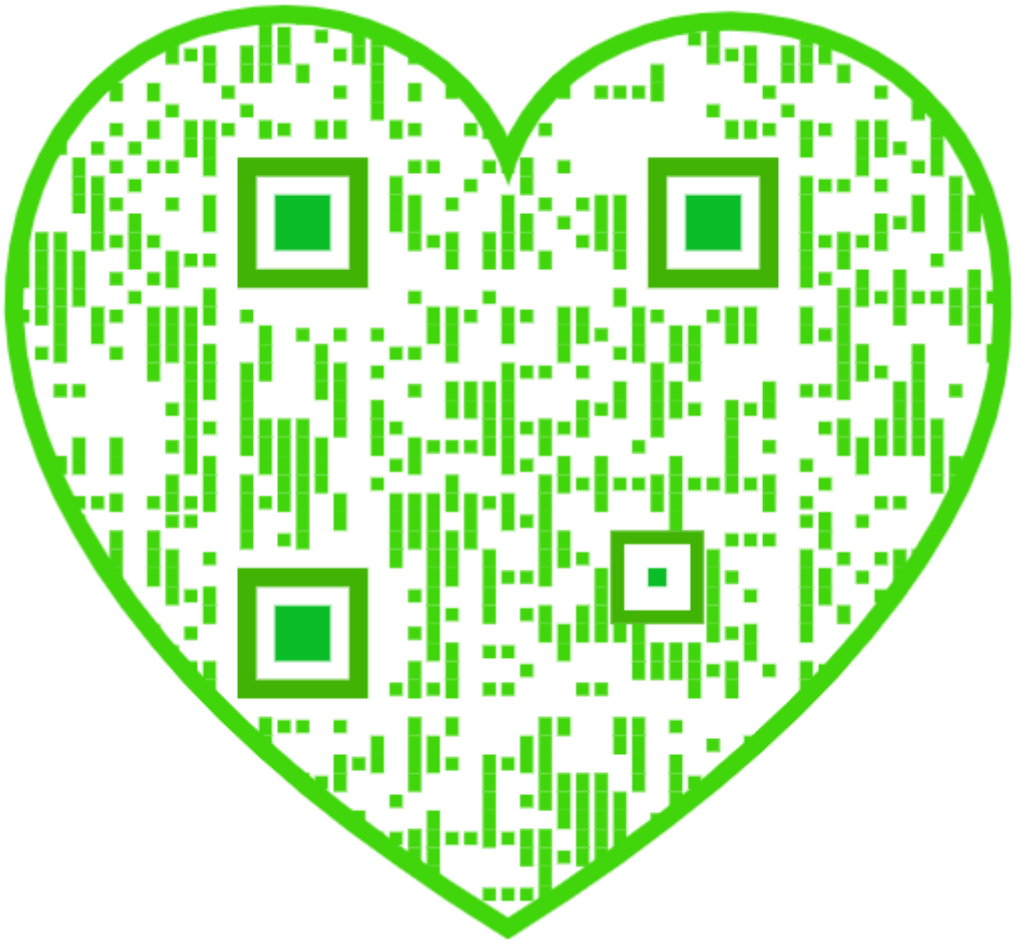

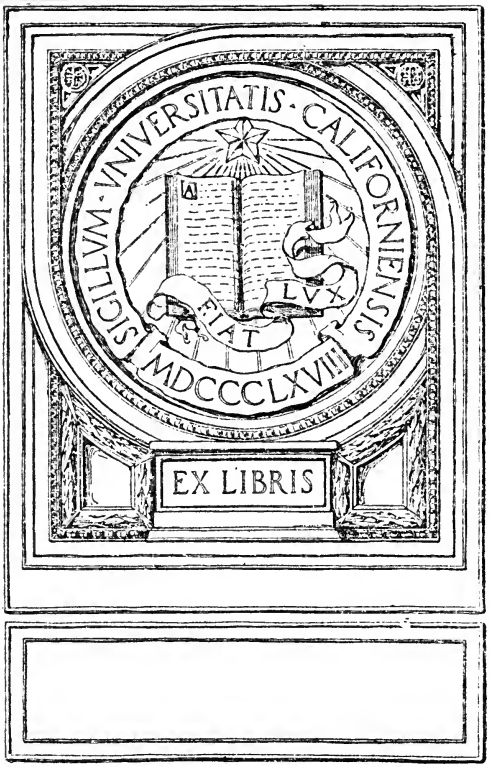
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HIDES & SKINS

AND THE

MANUFACTURE OF LEATHER

red.

A LAYMAN'S VIEW OF THE INDUSTRY

BY

JAMES PAUL WARBURG

Assistant Cashier

The First National Bank of Boston

Second Printing

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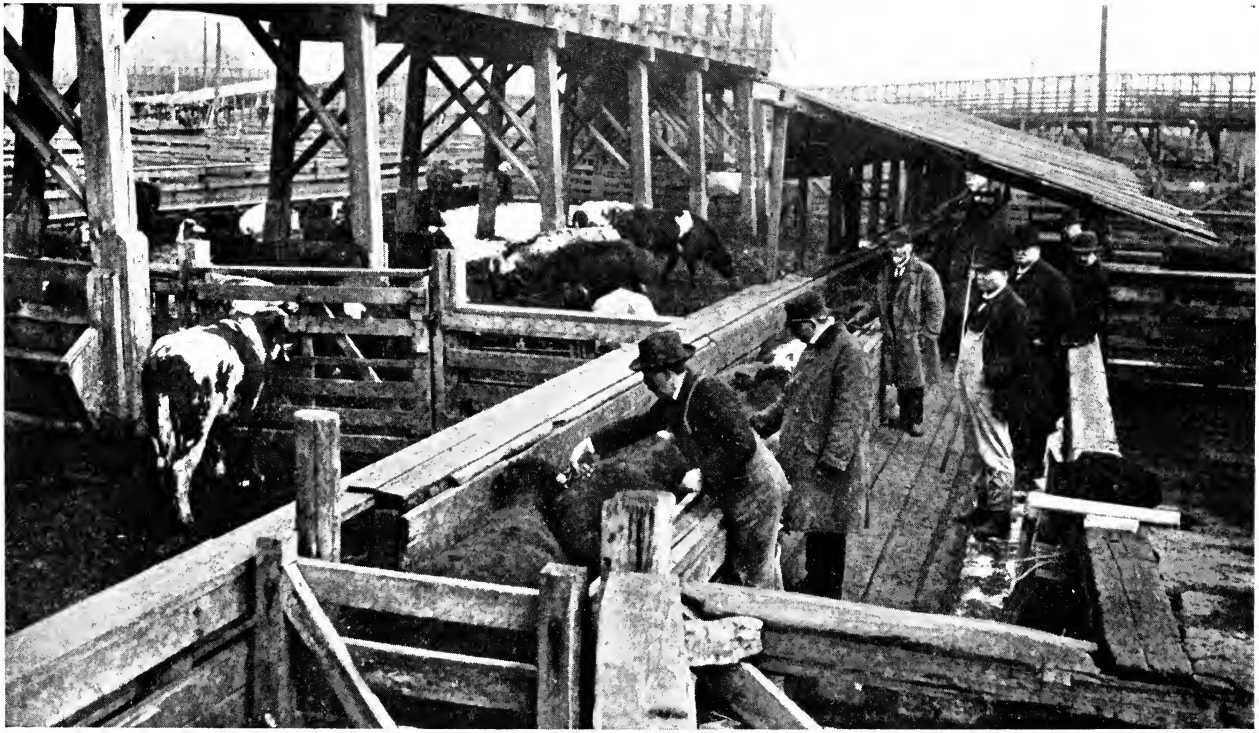

Inspection of Cattle before Killing

FOREWORD

The Evolution of the Industry

Probably every man who has ever seen leather knows it to be derived from the skin of various animals; but probably not one in ten even thinks that he understands just what has happened to the raw skin to make it leather; and, as a matter of fact, scientists are to this day divided in their opinions as to whether the change caused by tanning is chemical, or physical, or both. The twofold object of all tanning processes is to render the skin imputrescible and more or less elastic. The origin of how this was first accomplished cannot be traced, for the attempt to preserve the skins of animals dates back far beyond recorded history into the time of primitive savages. Specimens of ancient Egyptian leather, said to have been manufactured at least a thousand years before the birth of Christ, are still to be seen in a museum in Europe, and it is probable that the inhabitants of the Nile delta at that time were fully as versed in the art of tanning as were our ancestors in the reign of Queen Elizabeth.

We may picture to ourselves an early savage, wearing a dried pelt of some animal as a cloak. We may think of him at first surprised, and then considerably annoyed to find that the softness of the skin entirely disappeared as soon as it was thoroughly dry, giving place to an exceedingly disagreeable horniness. His first reaction would be to soak the skin in water in an attempt to render it once more supple. It was probably in this way that the natives of Japan discovered that the waters of certain streams had a softening and preservative effect upon skins, for they flowed over a bed-rock of alum. Until very recently Japanese white leather was produced in this primitive manner.

Failing such a fortunate freak of nature, our savage would find to his chagrin that as soon as his pelt had dried, it became once more hard, and furthermore began to show signs of decay. We may picture him then trying the effect of animal fats, or perhaps of smoke, or in some way discovering the preservative effect of twigs and pieces of bark. In any one of these ways, provided it were continued long enough, he might obtain a rudimentary tannage. To be sure, he would be far from producing a leather that could be made into a modern

shoe, but nevertheless he would possess a skin practically immune from decay, and softened to a certain degree.

The progress in the development of leather manufacture until mediaeval times was comparatively negligible, and historical data are lacking by which to trace its course. We know, however, that by the end of the sixteenth century the manufacture of curried leather was well established in Hungary, and that Spain was at that time producing a fair quality of morocco. Gradually the industry spread over Europe, America, and other parts of the world; machinery was slowly perfected to take the place of manual operations; new finishes, such as waxed calf and alum-tanned kid, were added to the old Spanish crup and cordovan leathers; and finally, about thirty years ago, scientific chemistry evolved the chroming process, by which it is estimated that ninety per cent. of the world's upper shoe leather is made to-day.

The remarkable feature of the industry, even now, remains the fact that it rests primarily on an empirical basis, far more so than any other of our primary industries. While it is probably true that medicinal herbs constituted the first chemical discovery of man, it may well be claimed that industrial chemistry, to which our present civilization owes so many of its material adjuncts, originated in the preservation of animal skins.

Besides the usage of leather for boot soles and uppers, there are an infinite number of purposes to which it has been adapted, some of which it will be impossible to treat here in even a cursory manner. It is not intended by these omissions in any way to belittle the importance of the subjects which the author has felt to lie beyond the scope of this pamphlet. Furthermore, in order to avoid duplication, the arbitrary expedient has been adopted of discussing in Part Two only the vegetable tannage of sole leather, and in Part Three only the chrome process for making upper boot leather. In this manner each method of tanning is taken up in detail in the field where it finds its greatest application, but it must not be inferred by the lay reader that sole leather is never chromed, or that no upper leather is made by the vegetable processes. While this fact is brought out later on, it cannot be too strongly emphasized at the outset.

To attempt a discussion of the entire industry within so brief a space is at best a precarious undertaking. For purposes of simplification the subject has been divided into four groups: 1. The Raw Material; that is, hides and skins, what they are, where they come from, how they are obtained, and their imperfections; also the materials by means of which they are made into leather. 2. The Manufacture of Sole and other Heavy Leather. 3. The Manufacture of Boot Upper, Glove, Book, and other Light Leather. 4. The Economic Distribution of the Industry.

Each of these groups is in itself a subject for a book far longer than this.

The illustrations contained in this booklet were made available through the courtesy of A. C. Lawrence Leather Company, Howes Brothers Company, Swift and Company, Turner Tanning Machinery Company and the Associated Industries of Massachusetts. To these and many other friends of The First National Bank of Boston in the leather industries the author is indebted not only for helpful advice and criticism, but for exceptional opportunities for first-hand observation. Much of the material contained in subsequent pages has been derived from other books and articles, especially from Mr. K. J. Adcock's admirable study of the industry, and valuable assistance was received from various trade publications. Finally, too much credit cannot be given to Mr. Perry D. Keating, of the staff of The First National Bank of Boston, for his assistance in much of the research work and compilation of statistical data.

Boston, Mass.

April 19, 1921.

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PART ONE

THE RAW MATERIAL

CHAPTER I

Hides

The hides and skins of various animals form, as we know, the raw material from which leather is manufactured. The term, "Hides," is applied to coverings of the larger animals, such as full-grown cattle, horses, or buffalo; while technically "Skins" are derived from smaller animals, for example, calves, sheep, or goats. The intermediate size between a large "skin" and a small "hide" is known to the trade as a "kip." This term, however, is not very clearly defined, being used with various meanings in different parts of the world. Where the pelt of a wild animal is dressed, the furrier always refers to it as a skin, no matter what the size of the animal.

"Hi

"Ski

"Ki

The heavier grades of hides are generally manufactured into sole and belting leather; those of extra large surface—"spready" hides—are often used for upholstery; and in some cases, as we shall see later, hides are split into several layers or thicknesses, and by this means used for the production of boot uppers of a variety known to the trade as "Side Leather." As a very general rule, one may say that hides, because of their greater thickness, are particularly the raw material of the sole and heavy leather tanner, while skins go naturally into the process of making upper shoe, bag, and glove leather. Inasmuch as these two industries are entirely separate and distinct, it will be advantageous to the reader to bear in mind this segregation from the start.

Skin
Upp
Leat

The hides used by sole-leather tanners in this country are of both foreign and domestic origin. The chief source of imported hides are the meat-freezing plants of South America, which of recent years have become a dominant factor not only in the world's supply of beef and mutton, but of hides and sheepskins as well. South American packer hides are known to the trade as "Frigorificos," and are preferred by many tanners over all other varieties. South American green-salted hides from smaller killing-plants are known as "Saladeros" and "Mataderos." Some hides are imported also from other countries, and they are used both for the manufacture of sole and upper leather. South Africa and Australia produce large quantities of first class hides, but imports into the United States from these sources are not very heavy.

Fore
Hid

East India hides, often known as kips, because of the small size of the Indian cattle, China hides, Russian horse, and Javanese water-buffalo hides also find their way to this country in smaller quantities.

Domestic Sources

As might be expected, the chief domestic supply is derived from the great meat-packing establishments of the Middle West. "Packer" hides not only dominate the markets in this country, but exercise a strong influence on hide markets throughout the world. Quite a large supply also comes from the smaller abattoirs in various cities, and to these must be added a considerable number obtained from local butchers throughout the country. Both "City" and "Country" hides, which compare to "Saladeros" and "Mataderos," command a lower price than "Packers," because they are not as a rule so well taken-off or cured.

Classification

All hides are bought and sold on a basis of so many cents per pound. They are classified by: 1. Geographical origin; 2. Take-off; 3. Weight and sex of the animal; and 4. Freedom from defects. Thus, to choose a random example: "Pennsylvania, Country, Light Native Steer, Free from Grubs." We shall discuss shortly the various defects which are found in hides and skins, but before leaving the subject of hide classification, it might be well to glance at a list of those terms which refer to weight and sex, and to the brand marks.

PACKER HIDES

Heavy Native Steer	Free of brand	60 lbs. and up
Spready Native Steer	Free of brand	6½ ft. across
Light Native Steer	Free of brand	50 to 60 lbs.
Extreme Light Native Steer	Free of brand	25 to 50 lbs.
Heavy Butt Branded Steer, Branded on butt, not over 18 in. above butt		60 lbs. and up
Light Butt Branded Steer	Same	50 to 60 lbs.
Extreme Light Butt Branded Steer	Same	25 to 50 lbs.
Heavy Colorado Steer, Side and butt branded, spready and thin		60 lbs. and up.
Light Colorado Steer	Same	50 to 60 lbs.
Extreme Light Colorado Steer	Same	25 to 50 lbs.
Heavy Texas Steer, Side and butt branded, smaller and plumper than Colorados		60 lbs. and up
Light Texas Steer	Same	50 to 60 lbs.
Extreme Light Texas Steer	Same	25 to 50 lbs.
Heavy Native Cows	Free of brand	55 lbs. and up
Light Native Cows	Free of brand	Under 55 lbs.
Branded Cows	Branded	25 lbs. and up
Native Bull	Free of brand	25 lbs. and up
Branded Bull	Branded	25 lbs. and up

COUNTRY HIDES

Buffs	Free of Brand	Cow or Bull Hide 45-60 lbs.
Heavy Cows	Free of Brand	60 lbs. and up
Extremes	Free of Brand	25-45 lbs.
Heavy Steers	Free of Brand	55 lbs. and up
Bulls	Free of Brand	60 lbs. and up
Branded Hides	Free of Brand	all weights

CHAPTER II

Skins

In the preceding chapter we dealt briefly with the raw material which is made into sole leather. When we come to consider the various kinds of skins which are used for the manufacture of so-called dressing leathers, we are at once confronted with such an array of different varieties, that, in order to avoid hopeless confusion, it becomes necessary to confine ourselves to a few of the most commonly used.

Kinds of Skin

Calf, goat, and sheep skins form by far the greatest proportion of the skins of smaller animals which are used for making leather. It is well to remember also that cattle hides, kips, and horse hides are extensively used for making boot uppers and bags. The "shell," or hide from the buttocks of the horse, is particularly valuable because of its fine grain, and is made into cordovan leather, while the remainder of the horse-hide is chiefly used for japanning into so-called "Patent" side leather. Pig-skin is an excellent material for bag and saddlery leather, the reason for its limited use being the difficulty of flaying it from the carcass. Other less frequently used skins are those of the dog, kangaroo, alligator, crocodile, seal, frog, chamois, antelope, and various kinds of deer.

Calf Skin

Kips and calf skins are obtained, generally speaking, from the same sources as hides. The bulk of the calf skins used in this country come from the Packers, others from outside city and country butchers, while a large quantity are imported from Europe, South America, India, and other parts of the world. The Chicago Packers sell their calf skins on a basis of cents per pound of weight; in most other markets, however, the skins are graded into groups by weight and then sold on a fixed price per skin. Different breeds of cattle, the age of the calf and its condition when killed, as well as the actual condition of the skin itself, are all factors in determining value. The chief use of calf skin leather is in making high grade men's boot uppers, and the heavier uppers for women's shoes.

Goat skins are the material from which are made the well-known glazed kid uppers for light, high grade men's and women's footwear. The leather made from these skins is easily distinguishable by its

Goat Skin

beautiful clear grain, which is more uniformly defined than that of calf skin. The chief difficulty lies in obtaining skins of sufficient substance to form a strong leather. Besides uppers many other articles are made from the skins of these animals; moroccos for book-binding, glove, bag and upholstery leather, and sundry articles such as purses, pocket-books, and ladies' belts. Practically no goats are bred in this country, except in Texas, so that the vast majority of the skins used are imported from foreign countries. Asia Minor, Spain, Austria, and the Cape are the chief sources of the kind of skins most suitable for glove leather, while the best skins for making glace kid are derived from India, China, Brazil, Mexico, the Cape, and other Asiatic countries. One of the highest grades, known as Patnas, come from the Indian province of Behar. The most desirable skins for the manufacture of morocco are produced on the European continent, particularly in Norway, Spain, and Germany. In this country goat skins are usually bought at a price per dozen.

Sheep-skin

Sheep are raised in a great many parts of the world, in fact almost everywhere except in countries where the excessive density of the population has made grazing impossible. Nevertheless good sheep skins are not as abundant as might be expected. The reason for this is that these animals are raised primarily for wool and mutton, and that, as a general rule, the higher the quality of the wool obtained, the less substantial is the skin. A large supply of domestic sheep skins is obtained from the slaughter-houses of the Middle West, but a great number are also imported from Australia, New Zealand, Africa, and other countries. South America produces tremendous quantities of sheep, but the skins are sent chiefly to the great pulleries at Mazamet, France. Sheep skins are used for making the cheaper grades of dressing leathers, and also, particularly those from the Cape, for gloves. A common practice is to split the skins of these animals, using the outer, or grain half (the skiver) for glove leather, and the lining for "chamois" or parchment.

Pig Skin

Pig skin yields a leather which, for certain purposes, such as saddlery, cannot be approached by any substitute. Nevertheless it is so costly to remove these skins, because of the large quantity of fat that is lost in the process, that most killers prefer to leave the skin on the carcass. Scotland and Germany are practically the only countries which produce pig skin in large quantity. Imitations, particularly for bags and portmanteaus, are numerous, but are detectible by the absence of the holes left by the bristles.

Other Animals

We have already mentioned some of the less frequently used skins of other mammals as well as those of some of the amphibious reptiles, and even fish. Given sufficient incentive, there are practically no skins

from which some sort of leather could not be made, and it is only because we have always had an ample supply of cattle, sheep, and goats, that these have become the standard raw materials for the leather industry.

CHAPTER III

Flaying and Curing

Much Inexpert Flaying

The methods by which the hides and skins are removed from the carcasses of slaughtered animals vary a great deal, according to the ideas prevalent in different countries. Moreover, a vast number of butchers still flay in an exceedingly antiquated manner, by which the hides are rendered practically useless to the leather manufacturer. Not only do inexpert slaughtermen often misshape the hides, instead of leaving them square, but frequently they actually cut holes or deep scores through careless handling of their knives. In many cases this is due to ignorance, in others to ill-warranted haste. Kosher killing somewhat reduces the value of a hide, because the entire throat is slashed.

Modern Methods

The French process of mechanical flaying, originally invented about ten years ago by Gaston Tainturier, is in great favor in Europe, and produces excellent results, as does also the English method of using a device known as the tail-extractor. The most efficient systems, however, are probably those developed by the American Packers, and more recently by the freezing plants of South America.

American Packer System

Without going into the details of how various kinds of animals are slaughtered, the procedure in the American plants is that of hanging the animal, immediately after it has been killed, by one or both of its hind legs. It then travels slowly along an overhead conveyor past a considerable number of workmen, each one of whom has a specific operation to perform. Thus, taking the case of cattle, which are first stunned by a severe blow on the head, the first man, known as the sticker, performs his task of sticking the throat and allowing the blood to drain. The "Header" then starts to remove the hide from the head, the "Leg-breakers" loosen it from the shanks, and the "Floorsmen," or "Siders," remove the skin from the sides. For this last operation the animal is laid on its back. After it is once more hung head-down, it passes in succession the "Rumpers," "Fell-cutters," and "Backers," whose names imply the parts of the animal from which they detach the hide. The process is completed by the "Droppers," who pull the hide off the neck and shoulders, and drop it on the floor for inspection.

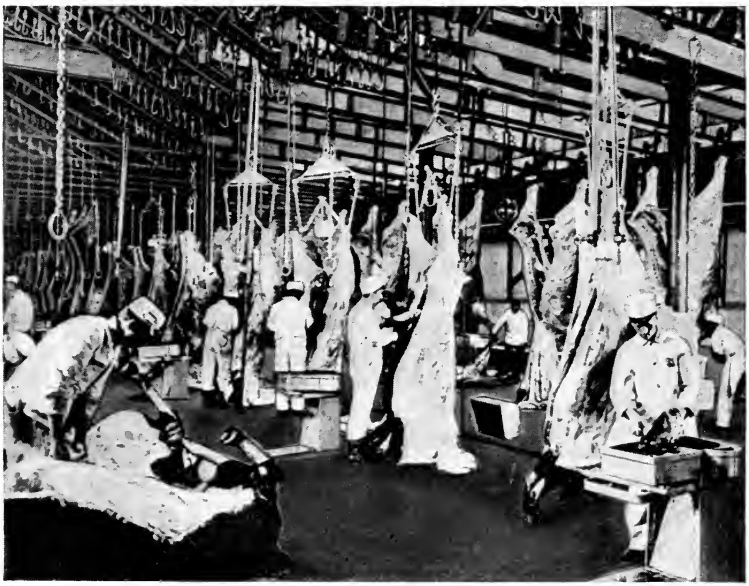
The foreman goes over each hide with great care, and if he discovers any cuts or scores, he is at once able to tell from their location

on the hide which workman is responsible. Accurate check is kept of all mistakes made in the work, so that an inefficient operative does not last for any length of time. *Check on Workmen*

After the ears have been cut, and the switches trimmed from the tails, the hides are graded into various selections, such as Branded Cows, Heavy Native Steers, etc.

Argentine Frigorifico hides compare favorably with those taken off by the American Packers, and are preferred by most sole leather tanners because they are cleaner, more carefully trimmed, and fleshed. The practice there is to bathe the cattle thoroughly before killing, and afterwards to wash the hides. The hair side is scraped under a spray of water and the flesh side severely brushed, after which the surplus flesh is scraped off. Accordingly there is less waste material on these hides than on any other kind, and as a rule, they command the highest price per pound. In the same way "Packers" are given a higher value than "Cities" or "Countries." *Frigorificos*

The flaying process varies, of course, with calves, sheep, goats, or other animals, but the general principle remains the same. The smaller and more tender the skin, the greater care is necessary to avoid damaging it.



Flaying Hides from Cattle

Curing

After the hide or skin has been removed from the animal it is necessary not only to wash it as clean of dirt, manure, and blood as possible, but also in some manner to preserve it against decay. The most primitive way is simply to dry the hides in a cool place away from the sun, before shipping them away in loose bundles. This practice is still followed in China, and to a certain extent, in India, Arabia, South America, and Mexico. Even under the most favorable circumstances a dried hide will lose considerable substance, because of the long soaking required before it can be put in the lime liquor. Very frequently, moreover, dried hides and skins are ruined by exposure to heat, or by the fact that they were dried too fast. In the latter case a certain amount of moisture remains in the center of the hide and quickly develops putrefaction, one indication of which is the loosening of the hair, known as "hair-slip."

Drying Unsatisfactory

Dry Salting

A better method is that of curing the skins with salt and then drying them, or of shipping them wet-salted to the tanner. The latter process is that used by the American Packers, and hides or skins treated in this manner are usually referred to as "green salted," as opposed to the dry salted condition in which most foreign hides are received. Frigorificos are soaked in brine and then shipped in a green salted condition. The use of impure salts, especially those containing gypsum, and also the excessive and uneven spreading of salt are likely to cause stains, which no amount of later treatment will completely remove. In modern packing plants the greatest care is exercised both in putting the hides in the salt beds, and in brushing them thoroughly when they are taken out. Inasmuch as hides are sold for so many cents per pound, it is essential that vendor and purchaser agree on the amount of tare caused by salt, manure and moisture.

Green Salting

Pickled Skins

One of the best methods of preserving skins is to pickle them in casks of brine, or acid and salt solution. This is frequently done with sheep and goat skins, but cannot be applied to hides, because of their size. Skins received from foreign countries, in this condition are very popular with the tanners of fine dressing leathers.

"India-tanned"

It has long been the practice in India to give the skins a rude preliminary tannage before shipping them to other parts of the world. Such skins are referred to by the trade as "India-tanned," a term misleading to the layman, because the tannage is only partial, and in effect amounts to nothing more than a method of curing, since the majority of tanners begin by eliminating its effects.

CHAPTER IV

Imperfections

Take-off or Curing Defects

Through being carelessly flayed from the carcass, hides and skins may be cut, scored, or improperly rounded. Through imperfect curing they may be excessively horny, putrefied within, stained by salt, or permanently discolored by the iron in bloody fragments of flesh which were not removed. These are the defects caused by human carelessness or ignorance, against which the tanner is on his guard. In addition there are a considerable number of natural causes which often decrease or destroy the value of an animal's skin.

Anthrax

All countries have to contend to a greater or less degree with diseases affecting live-stock. Perhaps the most virulent of all is the anthrax bacillus, which not only lays waste herds of cattle, but is easily communicated to other animals and to human beings. Pasteur first made his famous discovery of immunity rendered by innoculation with the attenuated virus with this germ, but even today, because of the extreme danger from this disease, it is customary in all civilized countries to destroy and cremate infected cattle. Dry hides from China and Russia not infrequently contain anthrax spores, and for this reason they are not permitted to enter this country without first being disinfected with bichloride of mercury.

Other Diseases

A milder fever, well-known in almost all parts of the world, is the hoof-and mouth disease, which is, however, curable and leaves no lasting damage. "Tick" fever caused great wastage in our Southern States until it was discovered that "dipping" the cattle three or four times a year prevented the tick fly from perpetrating its annual outrage.

Grubs

Greater than the damage caused by all animal diseases, except in abnormal times, is the nefarious work of the little insects known as "grubs." Of these there are two chief offenders, the hypoderma bovis, and the hypoderma lineatum, both commonly referred to as warble-flies. These insects lay their eggs on the hides of cattle, and the larvae eat their way through the hide. Whether they eat in or outwards is still a matter of acrimonious debate; some scientists contend that the egg is laid on the fet-locks of cattle, from which they are licked off,—thus finding their way into the digestive tract,—and that they then eat their way out usually along the spine; others maintain

that the eggs are laid along the spine, where the animal cannot lick them off, and that the larvae then penetrate the hide from the exterior. In any event, no successful cure has yet been developed, and the annual wastage is tremendous. In this country it is customary to consider a hide "grubby" if it contains more than 5 holes, during the months when the larva is doing its damage. A grubby hide is classed as a No. 2 hide and sells for a lower price per pound.

Sheep Defects

Sheep, while not affected by the warble-fly, have other similar insect enemies, such as the blow-fly and ticks. They also suffer from scabs, and during the winter months prior to shearing the grain of their skin is wrinkled, a defect known as "cockle," the cause of which is not definitely recognized.

Scratches

All animals, but particularly sheep and goats, scratch themselves on briars or cactus plant, or—though this ought not to be permitted—on barbed wire. India goat skins are particularly likely to show scars of this nature, which mar the grain and reduce the value of the skin.

The origin, grade, take-off, weight, sex, and freedom from imperfections are all things which the careful buyer of hides and skins must watch, in order that he may be able to estimate correctly what his yield of leather will be.

CHAPTER V

The Manufacturing Materials

Before proceeding to follow out the different methods of making leather from hides and skins, it may be useful to devote a brief space to the enumeration of those materials, which, when applied to the skin, convert it into leather. To do so, without anticipating some of the processes of manufacture, is not an easy task, and yet it would seem necessary in order to avoid confusion on the one hand, and lack of consecutive continuity on the other.

Taking only those processes the products of which are most familiar to the average reader, there are four general ways in which leather is made:

Four Principal Means of Making Leather

1. By vegetable tannage; most commonly used for sole, belting, and heavy bag leathers. Also for upper leathers.
2. By "chroming;" used chiefly for calf and kid upper leathers, but also for sole, belting, and other leathers.
3. By tawing; used for glove leather.
4. By oil tannage; used for making "chamois" or wash leather.

In addition there are certain other mineral and chemical tannages with which we shall not concern ourselves here. But it is important to realize that the four cardinal methods mentioned above are frequently employed in various combinations with each other, as we shall see later.

Vegetable Tannage

Vegetable tannage is obtained by soaking the raw skin in a solution containing either the twigs, barks, leaves, roots, or fruits of certain trees and shrubs, or else extracts made from them. There are a vast number of these vegetable materials which contain the colloidal substance, known as tannin. A few of the most important are:

Trees

(a). Oak, Hemlock, Willow, Wattle, Chestnut, Spruce, and Quebracho. The barks of these trees, or extracts made from their wood or bark, are very extensively used. Quebracho, a South American tree, yields a tannin which is rapidly displacing Oak in this country. The chief American sole leather tannages are: Oak (Quebracho), Hemlock, and Union (mixed Oak and Hemlock).

Shrubs

(b). Sumach and Gambier are the most important shrubs, both containing a tannin much used in tanning light dressing leathers, or in

finishing chromed calf and goat skins. Gambier, which comes from the Malay Archipelago, is also used extensively to strengthen bark liquors in sole leather tanning.

Fruits

(c) Valonia, made from the acorns of a Near Eastern oak tree, and Myrobalans, the unripe fruit of an Indian tree, are the most commonly used fruit extracts. Both contain a large proportion of ellagic acid, which deposits on leather what the trade knows as "bloom." Both are used chiefly in conjunction with other materials.

Besides these there are a tremendous number of other vegetable tanning materials. In a subsequent chapter we shall note some of the combinations used to obtain various effects.

The Chrome Process

Most of the calf and kid upper leather is now chromed, while side leather is usually chromed and then sometimes tanned superficially with vegetable materials; the chrome process is by far the most important of the mineral tannages. One of its great advantages is the speed with which it is completed, as against the great length of time required for most vegetable tannins to complete their work. The basis of this process, which we shall analyze more fully in due course, is Chrome Salt.

Tawing with Alum

Nearly all minerals have a tanning, or more properly, a tawing effect on hides and skins, but besides chrome salts, the only other process which finds wide commercial application is that of tawing glove leather with alum and salt. Formaldehyde, potassium salts, and other minerals have been used in combination tannages.

Oil Tannage

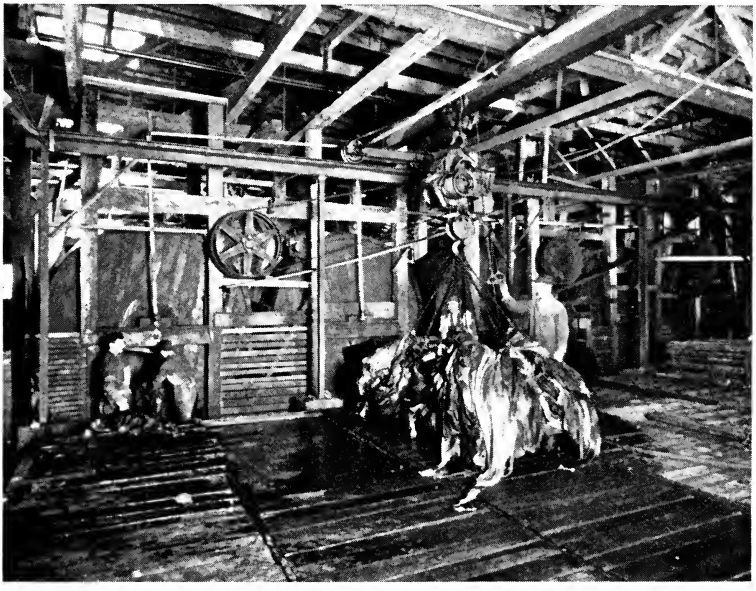
Animal oils, such as cod, whale, or menhaden oil, are oxidized and used to tan wash leather, which as we shall see, is made from the flesh-splits of sheep skins; this process is also used for making glove leather. Fats and brains are the tanning agent used for making a particular kind of soft leather, known as "crown" or "Helvetia."

There are numberless combinations being tried out every day, but the above represent the most commonly used materials, and form the basis of most tannages in commercial use at the present time. We shall not attempt to discuss here the numerous subsidiary materials, such as dye-stuffs and chemicals, which play such an important part in the industry, for to do so would lead us too far afield from the main topic.

PART TWO

THE MANUFACTURE OF SOLE LEATHER

Sorting Hides before Washing in Drum Tumbler



Soaking and Liming Pits with Crane Conveyor

CHAPTER VI

The Preparatory Processes

Since the tanning of hides into heavy leather and the converting of skins into upper shoe and dressing leathers are entirely separate and distinct,—almost as much so as the manufacture of cotton goods and woolens,—we shall follow first the hides of cattle through the sole leather tannery, and then, in Part Three, the manufacture of various kinds of light leathers from the skins of the smaller animals.

Soaking

The majority of the hides used by American sole leather tanners arrive at the tannery green-salted. The first thing to be done, after the hides have been opened out and sorted, is to remove all traces of salt and as much dirt as possible. In order to accomplish this the hides are soaked in clean soft water, until they are considered sufficiently clean. Where hides are received dry-salted, or simply flint dried, plain soaking will not remove the salt or make the hides pliable enough for the subsequent processes, unless they are left in water so long that a great deal of gelatinous substance is lost. It is therefore necessary to hasten the process by mechanical action, and often by chemicals as well. The mechanical method of softening usually consists of kneading the hides in a drum tumbler, which is nothing more than a hollow drum fitted with shelves like those of a paddle-wheel. As the drum rotates, the hides are given a thorough beating, and this process is frequently augmented by introducing acids or alkalies into the water in the drum.

Plain soaking is usually done in square, cement-lined pits, as is also the operation which suceeds it, namely that of liming. The primary object in placing the hides in lime liquor is to loosen the roots of the hair so that it may easily be removed, but the process is one of the most important in the tannery, and many experts claim that leather is made or ruined in the lime pit.

Liming

Since lime by itself does not very rapidly destroy the hair-bulbs it is customary to add some other depilatory agent, such as red arsenic or sulphide of sodium. The length of the process varies but hides are rarely left in lime liquor for more than four or five days. The methods also vary a great deal; some tanners do their liming in a single pit, others use what is known as the three-pit system, in which

Different Methods

each of three successive solutions is stronger than the last. One essential thing is that the pits must be stirred up at frequent intervals, and this used to be done by the ardous process of "pulling." A workman reaches down into the pit with a long two-handled instrument like a fire-tongs, only five times as long, and pulls out the hides, leaving them on the side of the pit to drain. This process has now been supplanted in some modern tanneries by mechanical devices such as paddle-vats which keep the liquors in motion; in a few tanneries, the hides are hung from poles joined to a connecting rod opposite ends of which are alternately raised and lowered. This contrivance, known as the "rocker pit," is more frequently applied to the coloring pits.

Other Depilatories

During their immersion in lime liquor the hides lose most of their natural grease, and the hair becomes sufficiently loose so that it will easily come off in the unhairing machine. There are other methods of depilation, such as sweating, which is frequently done with sheep skins, the hair being attacked by the putrefaction which rapidly develops in moist heat. A new method of removing hair by a treatment with enzymes is very efficient, but as yet too expensive to be commercially practicable.

Unhairing

The operation after liming, namely that of unhairing, was formerly the first of a series of manual tasks performed on a convex wooden surface called the beam, which still survives and gives the name of "beam-house" to the building in which these operations are now carried out by machinery. The dehairing instrument formerly used was a blunt knife with a concave edge, with which the hide was scraped downward over the beam, thus removing the loosened hair.

Unhairing Machine

There are various machines in use for unhairing, the two chief types being the serial table feed, and the roller feed. The latter is almost invariably used for hides, while the former is employed for light skins. The hides are fed over a roller, immediately after coming out of lime, between a soft felt or rubber backing and a cylinder armed with dull helical knives, which usually converge half to the left and half to the right. By this means the hair is scraped off and the hide slightly stretched.

Fleshing

The next thing is to remove the flesh adhering to the inner side, and this is done in a very similar manner. The old method was to use a knife with a sharp convex blade and a dull concave edge, using first one and then the other over the beam; but all this is now accomplished by a machine which differs very little from the one used to remove the hair. The only real difference is that the helical knives, instead of being blunt, are exceedingly sharp. Both the unhairing and fleshing machines work very much on the principle of the ordinary lawn-mower.

Whereas, as we shall see later, there remain several other preliminary processes in the making of upper leather, there only remain two in the making of hides into sole leather. The first consists in removing by hand what few short hairs have escaped the machine, and the second is simply the washing out of the lime which still remains in the hides. The latter is usually done in a drum, into which water is continually fed through a hollow axle, but is sometimes accomplished by means of an acid bath. The acid method, however, is rarely used for sole leather.

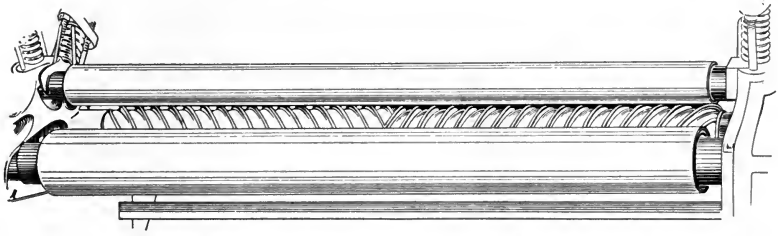
De-liming

After they have been cleansed the hides are ready for the tanning liquors, and from now on we must think of the hair side as the "grain."

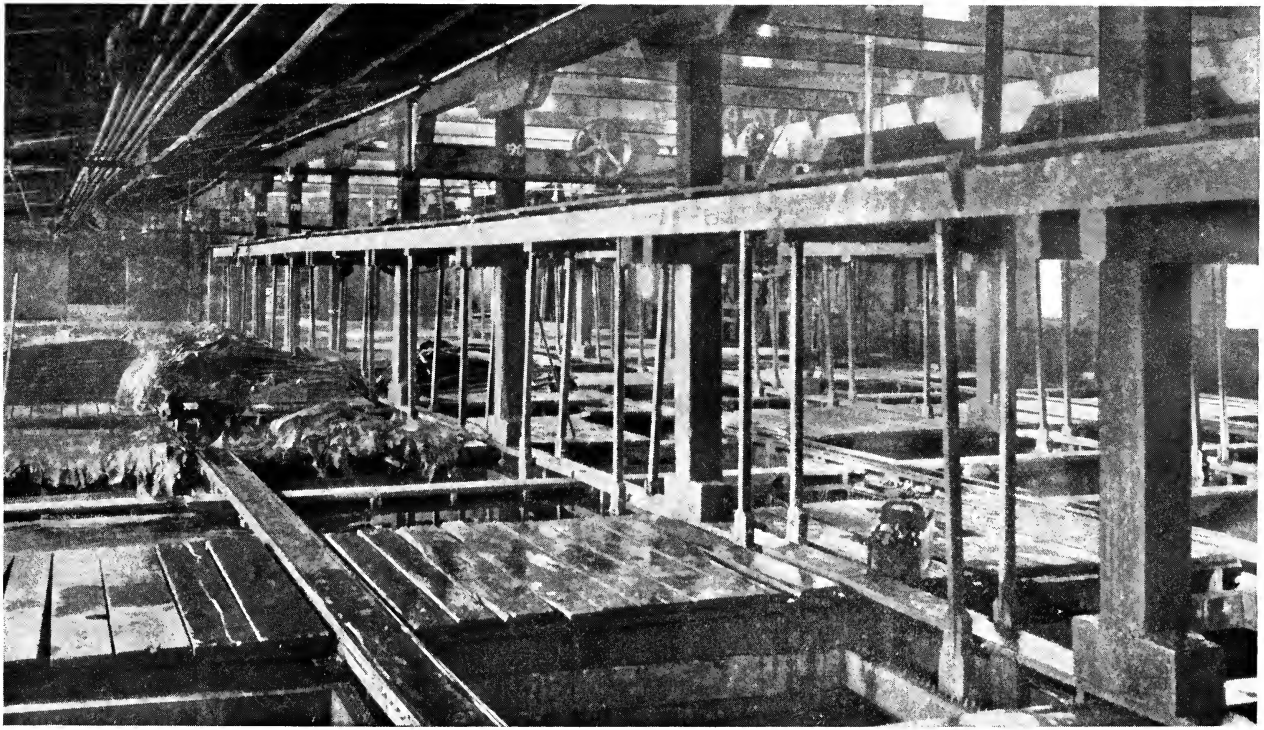
Unhairing

Fleshing

Trimming on the Beam



Working Cylinder of Fleshing Machine



Pit Tan Yard

CHAPTER VII

Vegetable Tanning of Sole Leather

When all the lime has been removed from the hides they have lost their hard gristly quality, and are in a more or less soft, plumped-out condition, which is ideally receptive to the tanning liquors. These are applied in one of two methods, known as the pit and the drum tannage.

Pit Tanning

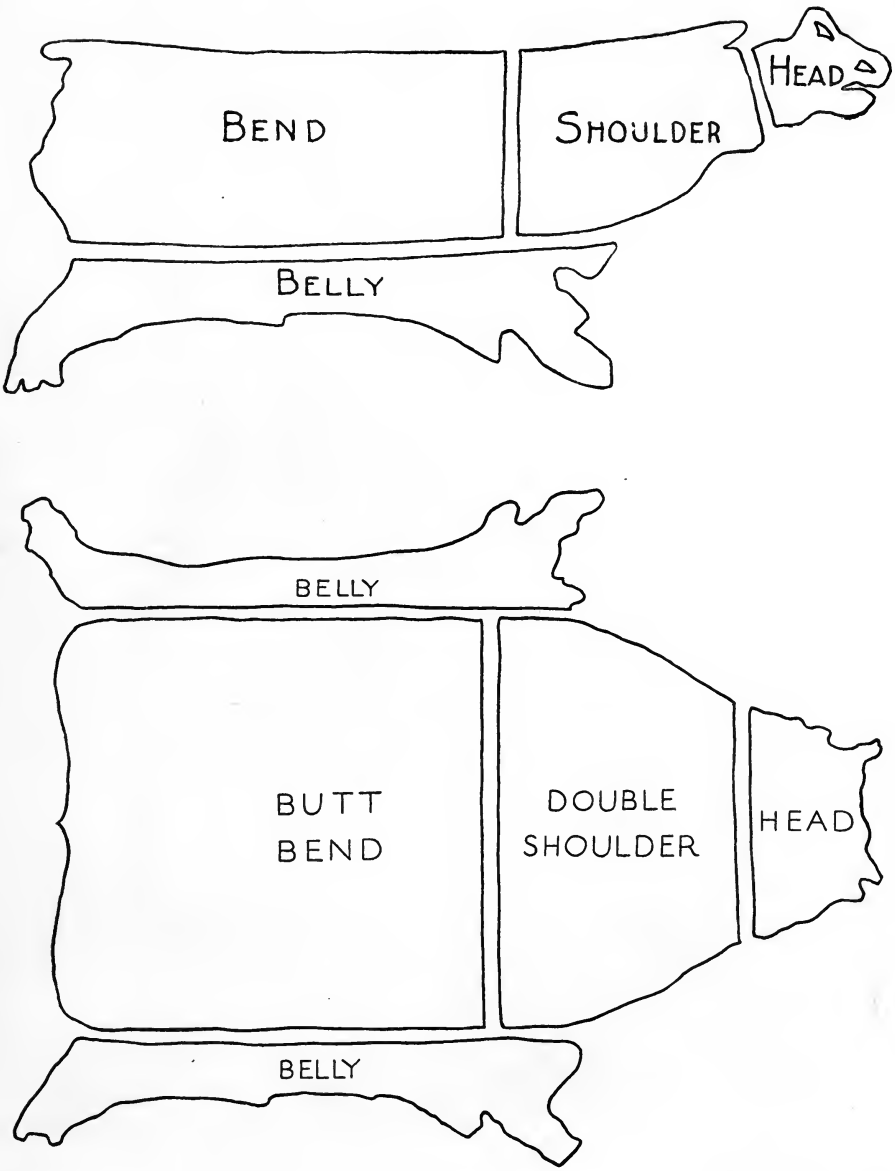
In pit tanning, the hides are slowly passed through three series of pits containing gradually strengthened tanning solutions. The first series are known as "suspenders," the second as "handlers," and the third as "layers" or "layaways." The object of this lengthy process is to secure an even tannage; and to this end the strength of the liquor is very carefully graduated. If strong extracts were used in the first pits the result would be a rapid tanning of the outer surfaces without permitting the tannin to penetrate within the hide. Such leather would quickly decay, and moreover its grain would be wrinkled and loose.

"Suspenders"

The first series of pits may consist of any number from six upwards, according to the size of the tannery. The hides are suspended, as we might expect, from wooden poles, and are frequently "rocked" by mechanical motion. Inasmuch as the leather gets its first coloring in this process, these pits are often referred to as "coloring pits."

"Rounding"

Hides are sometimes "rounded" before being placed in the suspenders, but more frequently, unless the bellies and heads are to be chromed, this operation is performed between the suspenders and "handlers." "Rounding" consists of cutting the hide into several parts. The chief section of the hide is the back of the animal from the neck to the tail. This is known as a "back." Sometimes this main section is cut in two parts, the "shoulder" and the "butt," the line being drawn across the back just behind the fore-legs. Frequently, also, the "back" is cut down the spine forming two "sides" instead of a "butt" and "shoulder." The "head," or "cheeks," are cut off at the neck, and each hide yields two strips of inferior leather known as "bellies," the remaining section being referred to as a "bend." The reason for separating the hide into these various portions is that different processes are frequently used in order to make out of them different kinds of sole leather or heel stock.



"Rounded" Hide, two Methods

The second series of pits, known as the "handlers," contains a stronger tanning solution than the first. Usually the liquor from the weakest "handler" is pumped into the last or strongest "suspender" pit. Similarly, the strongest "handler" derives its liquor from the weakest "layer." There are usually six or eight "handlers," and the liquors are frequently strengthened by extracts or gambier. In these pits, as in the succeeding "layaways," the hides are laid flat instead of being hung from poles. The first handler liquor usually reads about 25° on the barkometer (an instrument used to indicate the strength of tanning solutions), and this is gradually increased, until the final process is reached.

"Handlers"

In the "layers," of which there are usually five, strong extracts are used, which toughen the leather, the barkometer often registering as high as 100°. In order to give the leather what the trade calls "bloom" it is customary at this stage to add valonia, or some other substance containing ellagic acid. The length of time consumed in the pits varies with the kind of leather to be produced, and also with the ideas of different tanners. The general tendency is to hasten the process as much as possible by the use of stronger extracts, which often has a deleterious effect upon the product. Good vegetable-tanned sole leather remains in the pits for several months—sometimes for almost a year.

"Layers"

There is, however, one method of hastening the process, by the introduction of mechanical action. This system, known as drum tanning, is successfully used by many French and some American sole leather tanners. Drums with revolving paddle wheels keep the hides and liquors in motion, thereby so accelerating the process of impregnation, that, by gradually strengthening the liquors with extracts, hides can be tanned in a few days. The leather produced in this way, however, is not generally considered as durable as that tanned more slowly in the pits, and also is very likely to have a loose grain.

Drum Tanning

The oldest practice among sole leather tanners is to allow the hides to drain after being removed from each pit, but the desire for speedy production has brought about the common usage of mechanical contrivances, such as reels or cranes, by means of which the hides are transferred from one pit to another. Another way of shortening the process is to treat the hides with acid before putting them into the suspenders, the object being to make them more susceptible. Solubilized oils are also used to add greater water-proof quality and to permit of the use of stronger extracts.

Various Speeding Methods

The most commonly used vegetable materials for tanning sole leather in this country are: oak, quebracho, hemlock, valonia and gambier.

CHAPTER VIII.

Finishing Sole Leather

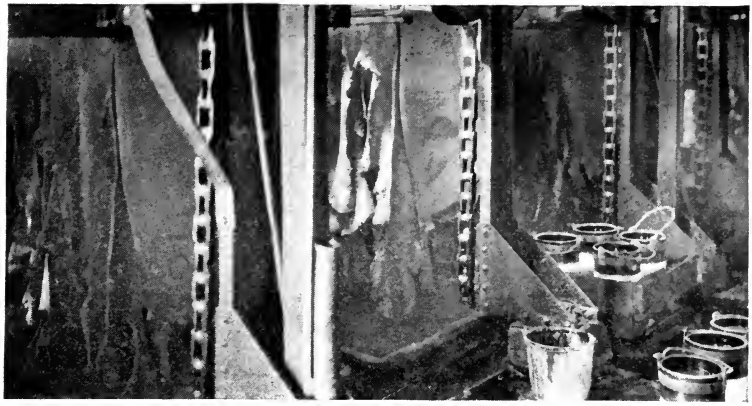
Strictly speaking, the conversion of hides into sole leather has been completed in the "layaways." However, since sole leather is sold, not by superficial measurement, but by weight, and since color and finish are important considerations affecting the price it commands, there remain a considerable number of operations before the product is ready for the market.

"Seasoning" The first of these finishing processes usually consists of what the tanner mysteriously calls "seasoning." As in any other industry, this term is used to cover a large field. Proper seasoning consists in fixing the tannin in the leather so that it will retain its condition, but in most cases this term means drumming the leather in strong hot extracts mixed with sulphonated animal oils. The result is not only a fixing, but a more complete saturation, lending additional weight and substance to the product. This process is often abused,—although not nearly so much now as formerly,—by the use of hygroscopic chemicals, such as barium salts, which swell the leather but are washed out as soon as it is exposed to water.

"Bleaching" The use of strong extracts not only saturates the leather, but gives it a dark brown color, which for some reason is not popular with the trade. Accordingly, the next operation is a bleaching process, which besides lightening the color, also serves to remove superfluous seasoning. If bleaching is carried too far it easily results in injury to the fibres.

Drying and Oiling As a rule the leather is now allowed to dry for several days, being hung for this purpose over wooden bars and placed in racks in the drying loft. After a sufficient time has elapsed it is taken down and oiled on the grain side with a swob, cod-oil being the most commonly used. After oiling, depending upon how thoroughly it has been dried, the leather may either be hung in the loft once more, or passed on at once to the setting-out machine.

"Setting-Out" When the leather is to be set-out, or pinned, as the old manual operation was called, it still contains a great deal of moisture; at this stage it is usually in what the tanner calls a "sammed" condition, meaning that if the piece is doubled over it will just barely exude

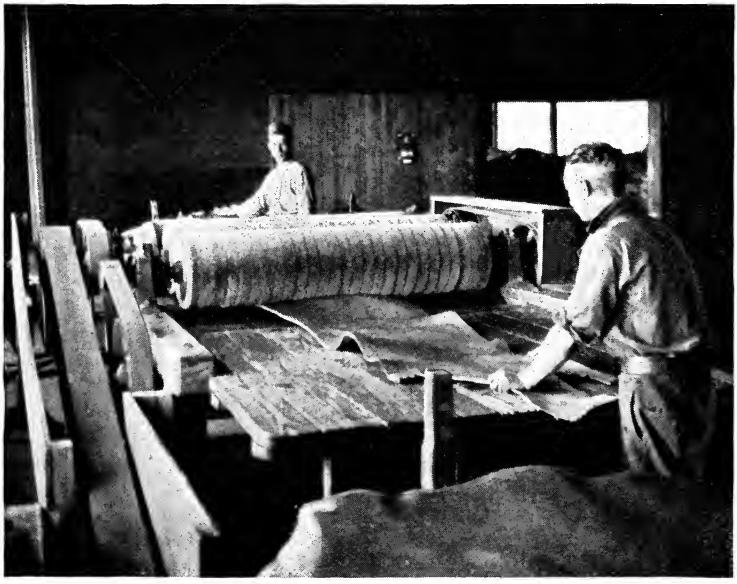


Bleaching

Oiling

Setting Out

Rolling



Brushing

moisture at the point where it is bent. It is obvious that pressure exerted upon leather in this condition will result in the squeezing out of the scum formed by surplus moisture and grease. This is precisely what the setting-out machine accomplishes, by means of two pairs of metal rollers. The scud is then scraped off, and after a little while the leather is ready for its first rolling.

In some tanneries the butt-bends are brought through to this point before they are cut down the center to form two sides. In others, the sides are separated at the time of rounding, between the "suspenders" and "handlers." In any case the next development is the same, namely that of rolling. Formerly this was done by pulling a heavily weighted roller over the leather, much as a man rolls a tennis-court, but machines are now everywhere in use.

"Rolling"

After the first rolling, the leather is again allowed to dry, this time until it contains very little moisture. It is then "sized" with a weak coloring matter, and rolled for the second time. After this some tanners use a machine called the striking-out machine, which, by exerting extreme pressure on a small part of the leather, smooths out the grain, particular care being taken to eliminate the wrinkles about the neck.

"Sizing"

The grain is then usually polished, either by hand, or by a machine buffer, after which it is inspected and ready for the purchaser. The finishing processes are not always precisely the same for the various parts of the hide, depending on what is to be made of them. Thus, while the bends of a given lot are made into high-grade sole-leather, the bellies might be chromed and finished as light chrome sole, while the heads were finished into heel stock. The chrome process will be taken up at greater length in connection with the manufacture of upper leather. Chrome sole-leather is extensively used for tennis and waterproof shoes. The finishing process for chrome sole differs chiefly in two particulars: first, the leather is stretched to regain some of the surface lost by treatment with astringents; and second, a fluffy nap is frequently raised on the flesh side by brushing up the fibres.

"Striking-Out"

CHAPTER IX

Other Heavy Leathers

There are several so-called heavy leathers, which are tanned in much the same way as sole leather, but finished in quite a different manner. Of a large class, known as industrial leathers, we shall consider only one, namely that used for the transmission of power.

Belting

The manufacture of belting proceeds along the same lines as that of sole-leather as far as the finishing process. After the tanning proper is completed, belting is given a treatment, designed to yield tensile strength rather than weight. As a rule only the butts are used for this purpose, the shoulders not being of sufficient strength.

Shaved Sumached and Stuffed

When taken out of tan the butts are first of all shaved in order to make them of one thickness throughout. (The shaving process is one with which we shall become more familiar in a subsequent chapter.) They are then washed and drummed in a strong sumach liquor, instead of being seasoned and bleached. After this they are struck-out to smooth the grain, and are ready for "stuffing."

In order to make it pliable as well as strong the leather is now impregnated with cod-oil and tallow. Formerly this was done by means of a hand swob, but the manual operation has been replaced in modern tanneries by a machine called the stuffing drum. Through the introduction of steam or hot air into the drum, it has become possible to use heavier greases than tallow.

Finishing

After this operation, the surplus grease is removed by scudding, similar to the setting-out of sole-leather, and the leather is then dried, rolled, and dried once more, after which it is cut up into the desired widths of belting.

Laminated and Chrome Belting

During recent years a large quantity of belting has been made by a different process which is cheaper, and yet is claimed to produce an equally strong product. This method consists in pasting together with collodion or some similar adhesive, a number of flesh splits of hides. Any number of splits may be used, and the belting produced in this way is fast gaining favor with manufacturers. Chromed belting has the advantage over vegetable-tanned material that it is not so susceptible to water or steam, but it has the disadvantage of being more likely to stretch.

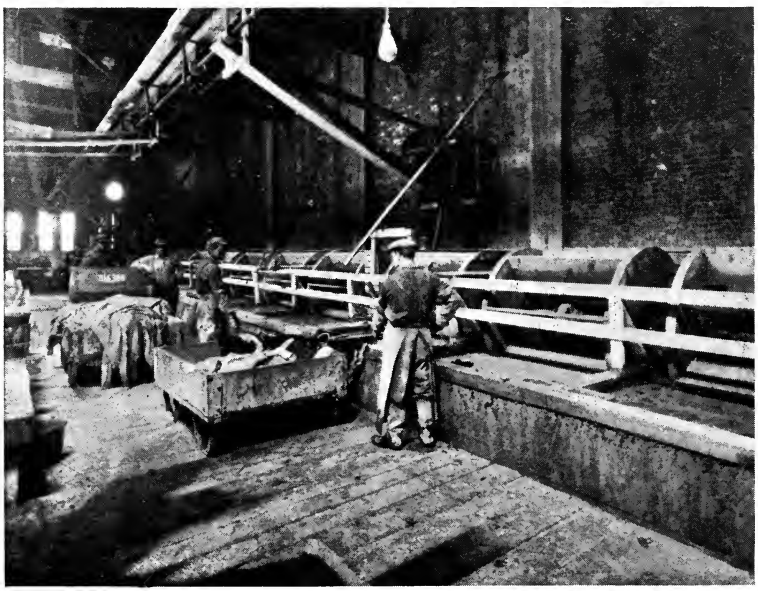
Harness Leather

The tanning and currying of harness and saddlery leathers is a separate trade in itself, but does not vary enough from the manufacture of sole and belting leathers to justify analysis here. Pig-skin finds its chief use in this field.

PART THREE

THE MANUFACTURE OF UPPER-SHOE AND DRESSING LEATHER

Sorting Skins



Paddle Vats

CHAPTER X

Calf Skins for Upper Shoe Leather

In the manufacture of the lighter leathers, the preparatory processes are in many ways similar to those employed in making sole leather. There are, however, many very important differences arising chiefly from two causes; first, the lighter substance of the raw materials, and second, the desire for softness and pliability. Upper shoe leather, which we shall consider first, is made from calf skins, goat skins, split hides (side leather), horse hides, and sheep skins. There are other less commonly used materials such as kangaroo. While some upper leather is vegetable tanned, fully 90% is produced by the chrome process.

Sorting

In preparing calf skins for tanning, a great deal depends upon the grade of the skins and the kind of leather to be produced. Accordingly the skins are carefully sorted into uniform lots.

Soaking Liming Unhairing and Fleshing

In the first processes, there is very little difference from the procedure we have just followed in preparing hides. The skins are first of all soaked for two or three days to remove all traces of salt or pickle. Then, instead of going at once into lime, they are usually fleshed; following this, they are laid—not hung as sole leather sometimes is—in the lime-pits, until the hair is sufficiently loose to be removed by the unhairing machine. The usual time is from six to ten days. As soon as the skins have been unhaired, they are washed in a drum tumbler, and again fleshed, this time more closely.

"Cheeking"

Some of the heavier grades of calf skins are "cheeked" before the second fleshing. This is a machine operation by which the thickest portion of the skin is levelled, and is performed so that all the leather may be of as even a thickness as possible. After the second fleshing, the skins are worked by hand over the beam to remove any short hairs or unevenness. When this is done, it is the custom in many tanneries to weigh and number the skins, which look at this stage very much like thin sheets of wet rubber.

"Bating"

Just as in the tanning of hides for heavy leather, it is necessary at this point to work out the remaining lime from the skins, but in addition, it is essential to render the material soft and supple. For this purpose the skins are now subjected to intense bacterial action, by placing them in a solution of animal dung. Where calf skins are to

Chrome Tanning Wheel

be finished into bag-leather, hen or pigeon dung is used, but where great pliability is desired, as for boot upper leather, a stronger agent such as dog manure is usually employed. The name given to this treatment is "bating," and of recent years its disagreeableness has been considerably lessened by the use of artificial puers such as "Oropon." At best, however, the process is far from pleasant, even though one no longer sees the workmen test the condition of the skins by biting them, as in former days.

Scudding

In order to remove the puer from the skins before putting them into the tanning solution, they are either scudded or washed in a drum tumbler. Some tanners use a "drench" of bran. "Scudding" consists in pressing and scraping out the scum and completes the preparation of calf skins for the chrome liquor.

Chrome Process

Chrome "tanning," which is really not a tannage, but a tawing process, is effected in one of two ways, known as the one-bath and two-bath methods. Both are usually preceded by an immersion of the skins in alum or sulphuric solution—pickle, as the tanner calls it,—which renders them more susceptible to the effects of chrome salts.

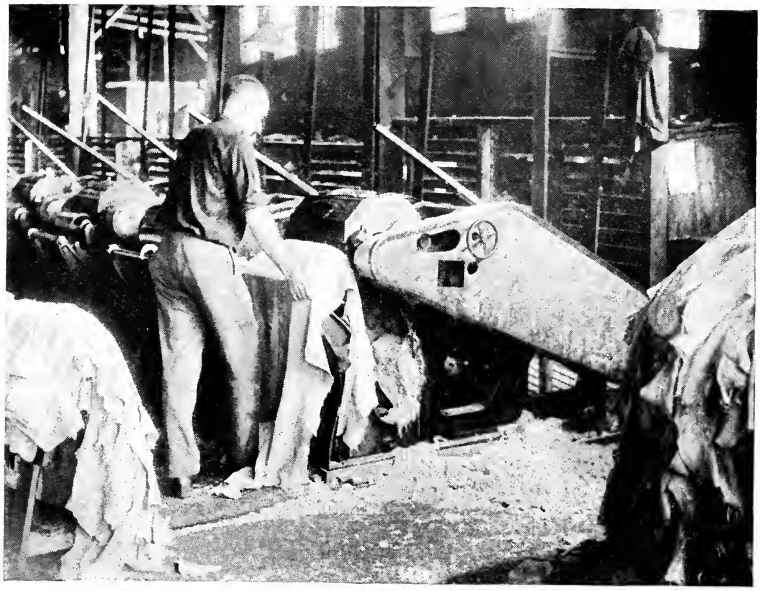
One-Bath Method

In the one-bath method the skins are soaked in a liquor containing basic chromium sulphate or chloride, obtained by a mixture of chrome alum and common soda or bichromate of potash, or by reducing chromic acid with glucose. The one-bath system usually employs a drum tumbler in which the solution is gradually strengthened.

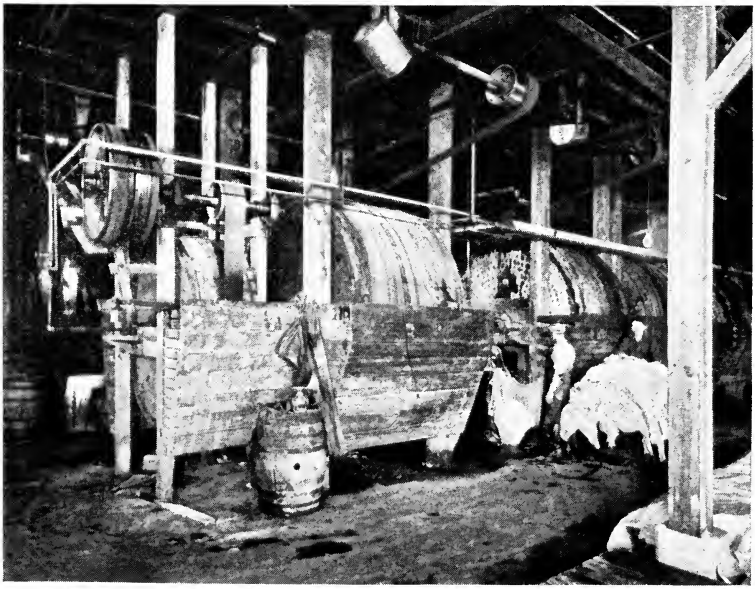
Two-Bath Method

The two-bath process requires more care, since a slight error in mixing the ingredients would entirely alter the character of the leather. In the first bath, the skins are placed in a covered paddle-vat, or in a drum-tumbler, and exposed to the action of chromic acid. The latter is obtained from bichromate of potash and muriatic acid. This solution turns the skins to a light orange color and leaves them in a state which is poisonous to the touch. Some tanners "strike-out" the leather between the two baths, in order to remove all wrinkles. The object of the second bath is to reduce the acid to an inert oxide, and this is usually accomplished in a drum-tumbler containing a solution of hypo-sulphite of soda and muriatic acid. This process produces a sulphurous acid and turns the leather to a dark dirty brown. Then, as the chemical action continues, the sulphur works free, leaving the skins a pale bluish color, which can be made completely white by adding more soda.

The chrome process finds its most universal application in conjunction with the making of calf, side, and kid upper leather. It must be remembered, however, that it is used as well in the manufacture of sole and belting and also of recent years in making glove and fancy leathers.



Shaving Machine



A Row of Fat-Liquoring Drums

As soon as the chromed skins are taken from the last drum-tumbler, they are hung on wooden horses to drain. They are then "set out" by a machine similar to that used for sole leather, only lighter. When the surplus moisture has thus been removed, it is usual to shave the skins on the flesh side, in order to make them of even thickness throughout. *Setting-out*

Before adequate machinery was invented, this operation was done by hand and caused a large amount of wastage. The modern shaving machine is a triumph of mechanical precision, and deserves detailed study, which unfortunately for want of space, we cannot devote to it here. The principle is once more that of the lawn-mower—a rapidly revolving cylinder armed with sharp helical knives—the adjustment of which is a matter of great delicacy. *Shaving*

After a satisfactory flesh surface has been obtained, the skins are sorted into various lots, to be colored in different shades. This sorting constitutes a very important factor in the results gained by the tanner, and the man to whom this task is delegated must be highly trained. Calf skins may be finished in a great number of different ways, and it is at this point, after shaving, that the manufacturer must finally determine which one of the many finishes is to be applied to each lot of skins. *Sorting*

The next process is usually referred to as "fat-liquoring," and comprises three distinct features,—coloring, filling and oiling. All three of these processes are sometimes combined into one, but more often they are effected in different drums. Dyeing is done in many ways, in drums, vats and even by dipping. The dye-stuffs used vary a great deal and constitute a study in themselves. Sumach or gambier are frequently used in this process both as coloring agents and to give a supplementary vegetable tannage. Fat-liquoring proper consists of filling the leather with soaps, oils, starch, china clay, tallow, egg yolk, or a great number of other materials. The object is to strengthen the fibres and render the leather soft and pliable, at the same time giving it the desired color. The process is usually carried out at high temperature in the drum tumbler and changes the leather from its bluish tint to black or colors. *Coloring "Fat-Liquoring"*

The skins are now hung to dry, after which they are "set-out" to remove the superfluous matter. An operation known as "shanking" smoothes out the wrinkles in the shanks, and the leather is then allowed to dry until it reaches a "sammed" condition, after which it is laid in damp sawdust until it is soft enough to be "staked."

"Staking" is an operation somewhat similar to "setting-out." Its object is to smooth the surfaces, remove foreign matter, and make the leather supple,—in fact, this one treatment changes the "crusty" skins *Staking*

into what looks to the layman like finished leather. There are several types of staking machines: in some the leather is pulled over a blunt edge by a mechanical contrivance, which reminds the uninitiated observer of the jaws of a crocodile, which reach out and grasp the material and then let it slip out between them; in another type of machine the skins are laid on an inclined surface and are curried by a blunt knife fixed at the end of a wooden arm, the action of which is reminiscent of a grasshopper's hind leg. (See fig.)

Straining

Each skin is now tacked on a wooden board in such a way as to stretch it in all directions, so that some of the shrinkage caused by the chrome process is regained. Inasmuch as upper leather is sold by superficial measurement, and not by weight, as in the case of sole leather, this operation known as "straining" is of considerable importance. When the skins have been sufficiently dried, they are removed from the board and usually given a second "staking," which, however, is not necessary with the lighter skins. Following this, the rough edges are trimmed off by hand and the grain is usually brushed.

Seasoning

The next process, known as seasoning, is not like the seasoning of sole leather, although it does to a certain extent serve the same purposes. The leather is fed by a belt conveyor between several rollers, which act in a similar manner to those on a printing press, impregnating the surface with a mixture of wax, shellac, and paint. The objects to be obtained are color, finish, and smoothness. Many tanners prefer to apply their seasoning by hand, and the mixture used varies a great deal with the ultimate finish to be produced. As soon as the last coat is dry, the leather is ready for its final treatment, which consists of being given any one of a number of finishes.

Finishes

Calf-skin is finished in three general ways: first, the smooth grain finish,—glace, gun-metal, etc.; second, boarded grain finish,—box and willow; and third, flesh finish,—ooze and suede. There are many variations for all three methods, and all are used both for colors and blacks.

1. *Smooth grain*

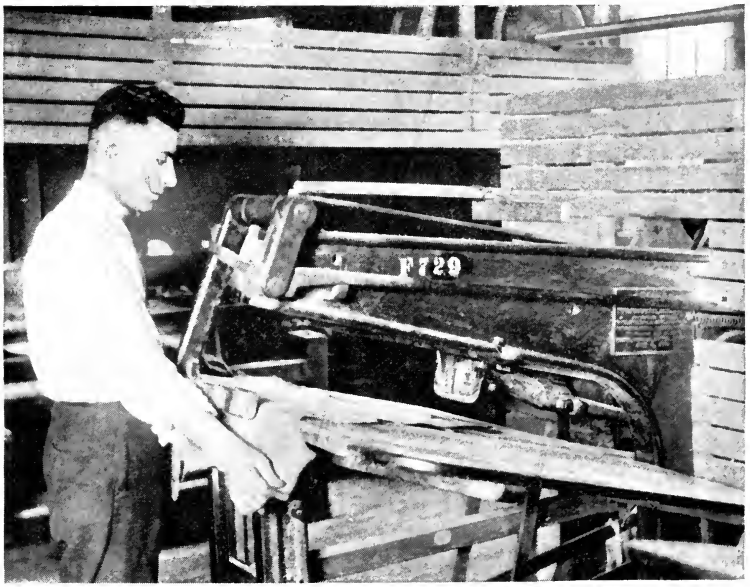
a. Glazing

Glazing consists of giving the leather a permanent polish by rubbing it at high pressure with a glass sleeker. The operation resembles staking with a grasshopper type of machine,—the chief difference being that the working tool, instead of a knife, is a small fixed cylinder of glass. Some manufacturers glaze more than once, depending upon the height of polish desired.

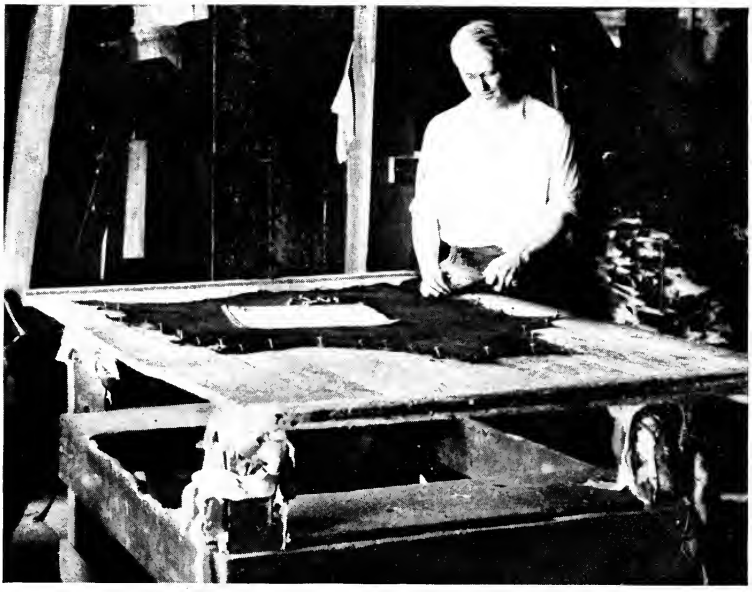
"Gun-metal" b. Plating

Where a duller surface is to be obtained, glazing is supplanted by "plating," which consists of pressing the leather in a contrivance much like that in which an up-to-date tailor presses his customers' trousers. The resulting finish is smooth but not very shiny, and is usually called "gun-metal."

Slocum Staking Machine



Baker Staking Machine (*Grasshopper type*)



Straining

Seasoning and Drying

A so-called "mat finish" is obtained by dressing the grain with olive oil, thereby giving it a certain "draggy" quality desirable for boot tops. Such leather has the advantage of superior softness and comfort.

c. "Mat-finish"

In some types of shoes, notably in English brogans, the public has become accustomed to a leather which shows a distinct grain marking. This is achieved by pressure on the grain surface with a cork board ("boarding"), which brings out the natural depressions in the skin left by the roots of the hair. Boarding is usually done by hand, with a tool which fits on the workman's fore-arm. When finished black such leather is known as "Box" calf, being named after the originator of the process. The same finish in colors is usually referred to as "Willow" calf.

2. "Boarded" Grain

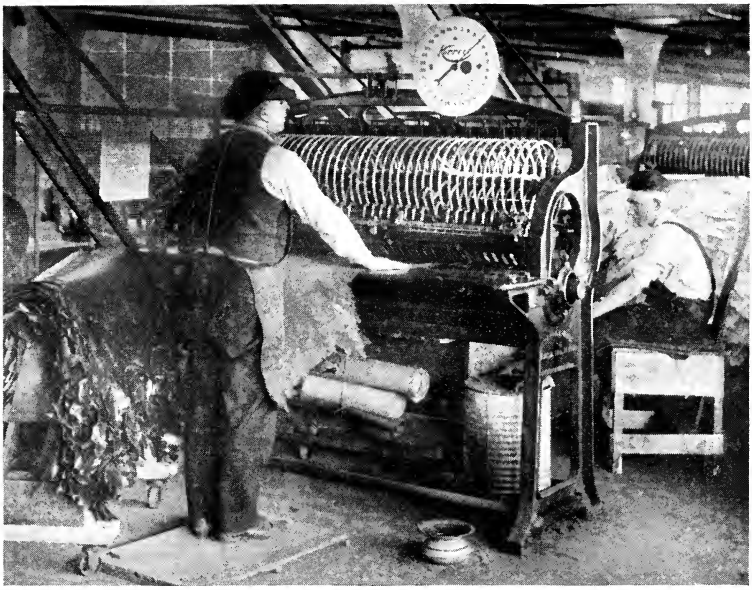
"Box" and "Willow"

The flesh side of calf-skin lends itself readily to being raised in a short nap. This is accomplished by severe brushing, which produces a soft velvety surface. Such finishes, known as suede or ooze, are exceedingly popular for certain types of ladies' shoes.

3. Flesh Finish

Where a piece of leather reaches the finishing stage with an imperfect grain, it is often, if not flesh-finished, submitted to an operation called "snuffing." The latter consists in smoothing down the grain on a wheel armed with carborundum cloth, or similar abrasive, by means of which a very satisfactory surface can be obtained, although it will, of course, lack the natural grain markings. Such "snuffed" leather is of secondary grade and is sold as corrected-grain calf, under various mysterious trade names.

4. Snuffing



Mechanical Foot Counter

Sorting and Making Bundles

CHAPTER XI

Side and Patent Leather

If the truth were known, a great many of us, who fondly cherish the belief that our pedal extremities are clothed in calf-skin uppers, would be sadly disillusioned; for much of the leather known to the public as "calf" comes in reality from an animal which has long forgotten its calf-hood. Practically every known finish of calf-skin has been imitated more or less successfully in "side leather," and in many cases it would tax the eye of an expert to detect the difference. It is distinctly to the credit of the shoe and leather trades in this country that one may fairly state that the public is really only deceived where it deceives itself.

Imitations of Calf

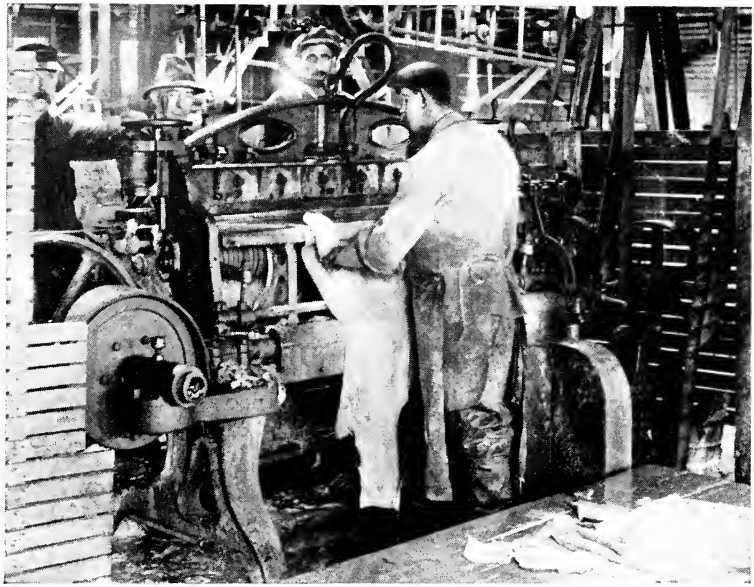
What then is this mysterious "side-leather?" Nothing more than the hides of full-grown cattle, split into several thicknesses. The procedure of making this kind of leather is so similar to the manufacture of calf, which we have just discussed, that for our purposes it is necessary to concern ourselves only with a few salient differences.

To begin with, the hides are sorted in the hide-cellar into various weights and qualities. They are then trimmed around the heads, switches, and shanks, and split down the spine into two sections, or "sides." It does not necessarily follow that the two sides from the same hide would go into the same sort, for one side might be branded or scored while the other was not. Soaking and liming then follow, some tanners giving the sides a fleshing before they go into lime. More frequently both fleshing and unhairing take place after the lime bath.

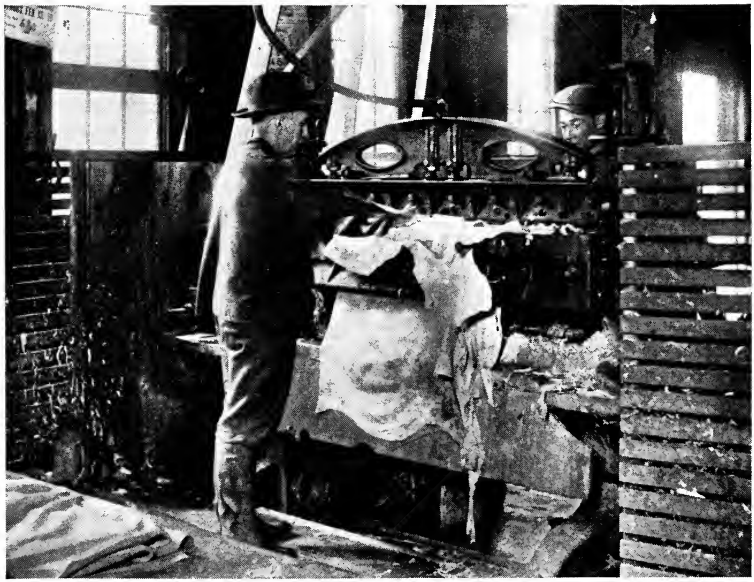
Cut into Sides

In most tanneries the hides are scudded when they come out of lime and then split, which has the advantage of permitting an entirely different treatment for the grain and flesh splits. In some cases, however, instead of "splitting out of lime," the hides are "split out of tan" at a later stage of the process. The splitting machine operates in a manner fascinating to observe; the sides are fed in, butt first, over a series of rollers until they meet an exceedingly sharp and rapidly revolving band-knife, which slices through in such a manner that the top, or grain split is of even thickness throughout. The exact thickness

Splitting



Feed End of Splitting Machine



Delivery End showing two Splits

can be regulated, and all unevennesses in the hide are compensated for by a multisection brass roller. Some sides are split only once, but frequently, with large heavy hides in particular, the lower section is made into several flesh splits. *Splitting Machine*

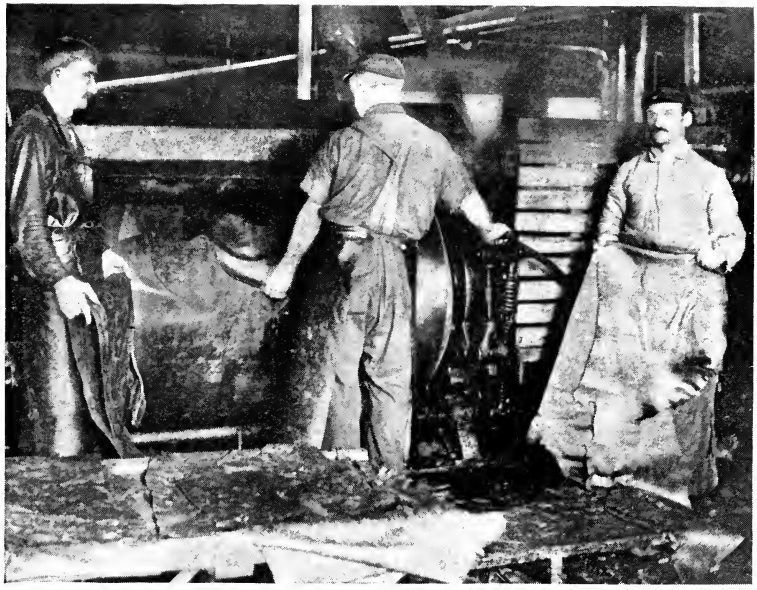
The regular procedure of bating, drenching, and scudding is now resumed and the split sides are chromed, colored and fat-liquored in much the same way as calf-skins. Samming, damping in sawdust, staking, straining, and re-staking follow in due course until the finishing operations are reached.

Side leather may now be finished in any one of the ways in which we have seen calf-skins treated. Its texture is, of course, not as fine, nor does it have the grain marking of calf leather, for which reason it is more frequently snuffed and given a gun-metal finish. It is however, perfectly feasible to produce in side leather a grain which only an expert would detect as artificial. This is done by various methods of embossing and printing. *Finishing*

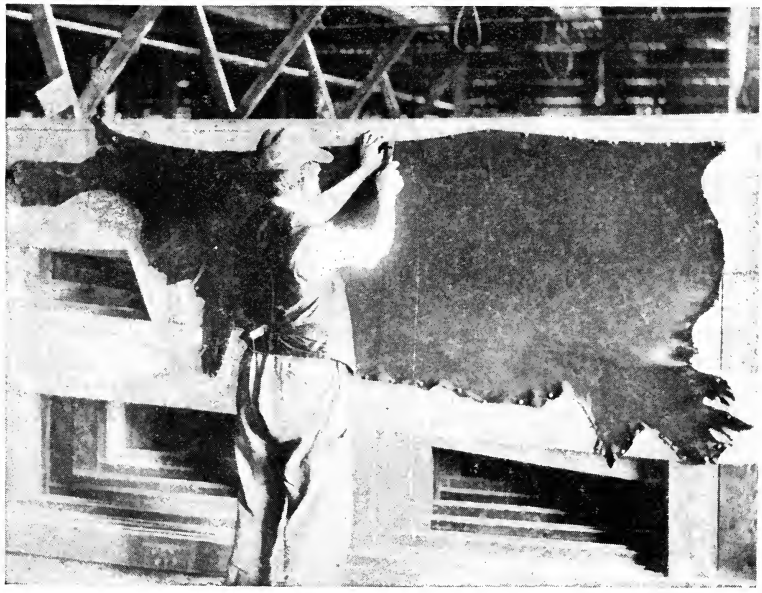
One very important finish applied to side leather is the japanning process, which produces so-called patent-leather. This treatment varies considerably from all other finishes, in that the sides are de-greased in benzine solution after being fat-liquored. This is necessary in order that the succeeding treatment may take proper effect. The sides, which have been colored a dark purple, are then stretched on wooden frames by means of tacks along the back, and clips and strings along the shanks and belly. The leather is left on these frames until the entire japanning treatment has been completed. *Patent Leather*

The process itself consists of three coats, after the application of each one of which the frames are placed on racks in huge ovens and baked. Some German manufacturers japan the flesh side, but in this country all three coats are applied on the grain. The first consists of a priming solution containing amyl acetate and banana oil, the second contains more black and a certain amount of varnish, and the last is given almost entirely to add lustre. Usually, where possible, the frames are then placed in the sun. The result of this treatment is no doubt familiar to the reader in the smooth, glossy, black patent-leather used for dress shoes and bags. *Three Coats Baked*

It is well to note here that, while the majority of our patent leather is made from japanned sides not all of it is derived from the hides of cattle. Horse-hides, and particularly Russian colt-skins, are the material par excellence for this purpose, and German patent leather is made to a large extent from goat-skins.

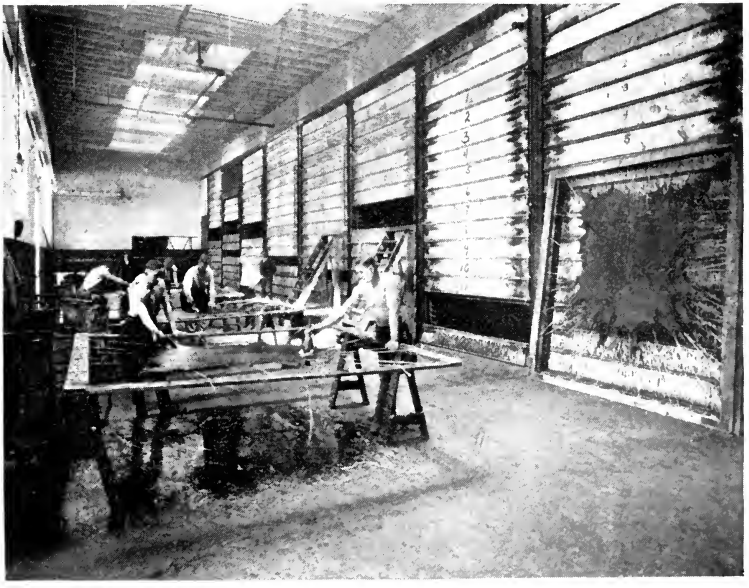


Setting out Side Leather



Straining Side Leather

"Toggling" before Japanning



Varnishing Room, Showing Ovens

CHAPTER XII

Goat-skins and "Kid" Upper Leather

Goat-skins All Imported

The famous glacé kid upper leather, and dull finished kid are two of the most popular leathers used for high-grade footwear. Both are made from the skins of goats, which are imported from various parts of the world. The small Indian goat has a particularly fine-grained hard pelt, and these skins, known as Patnas and Behars, are generally considered the most desirable. Goat-skins from China, Turkey, Europe and Mexico are usually somewhat larger and softer, and are, therefore, treated in a slightly different manner.

Preservation

Goat-skins are shipped green-salted, or dry, or pickled in barrels. The latter is the most desirable method of preservation from the point of view of the tanner, but, because of the expense, is usually restricted to kid-skins to be used for gloves. Some India skins are roughly tanned with babool by the natives, and are known as India-tanned goat-skins; inasmuch as this preliminary tannage has to be off-set to a certain extent, these skins are not very popular, except with certain manufacturers who use the babool tannage as a basis for their subsequent processes.

Sorting

The first step in the tannery is the assorting of bales into grades and weights, after which, as the bales are opened, the skins are sorted carefully and put into different lots, the aim being to have the skins in each lot as uniform as to kind, size, and weight, as possible. The shanks and switches are then trimmed, and the skins are weighed and numbered.

Beam House Operations

The soaking process varies with the manner in which the skins have been preserved, and is sometimes augmented by mechanical action. Very frequently a drum-tumbler is used to open the pores and make the skins susceptible to the lime. Most kid tanners use two successively stronger lime solutions, leaving the skins in each for a varying number of days, according to the type of skins and the time of year.

Unhairing, washing, and fleshing then follow in this order, the hair being separated into black and white, and carefully gathered up. The machines used are similar, but of a lighter type than those used for hides and calf-skins. After being fleshed, the skins are gristly and

tough, and in order to alter this condition they are given a strong bating with dog-manure or Oropon. They are then scudded, (or "slated," to use strict goat terminology), washed, and gone over by hand, after which they are ready to leave the beam house.

Chroming

Most goat-skins are "tanned" by the two-bath chrome process already described in a previous chapter. Between the chrome bath and the "hypo" they are almost invariably struck out to remove all wrinkles. After the second bath they are placed on horses to drain, and are then ready to be shaved.

A few of the thickest goat-skins have a thin split taken off the butt; the majority, however, are shaved until the skin is of an even thickness. They are then sorted for colors or blacks and sent to the fat-liquoring room. After the skins have been dyed and drummed in fat-liquor, they are put-out. This operation, similar to setting-out, "brings down" the grain and produces a smooth surface. The leather is then well oiled on the grain and hung up to dry for a certain length of time, after which the skins are allowed to "lie in crust" until they are ready to be damped in sawdust and staked.

Fat-liquoring

Before seasoning, the edges are trimmed, and the unshaved parts of the flesh sides are buffed. Seasoning is very important in this kind of leather, and there are an infinite number of combinations used to lay a good foundation for glazing. If a dull finish is to be produced the seasoning is very much lighter and the leather is either plated or ironed by hand.

Finishing

Glace and Dull

Kid leather is marked by an unusually fine and characteristic grain, which looks particularly well after it has been glazed. It is lighter in substance than calfskin, but more closely knit, and for these reasons forms an ideal material for ladies' shoes. Moreover, goat-skin can be dyed a great number of different shades of color which are not ordinarily used for calf or side leather.

CHAPTER XIII

Other Upper Leather

The great majority of boot and shoe uppers are made from calf, goat, or side leather. Before proceeding, however, to a brief consideration of other light leathers, such as those used for gloves, bags, and book-binding, it is necessary at least to mention a few of the materials less commonly used, but nevertheless very important, in the manufacture of shoes.

Horse Hides

It has been noted that horse hides and colt-skins are employed for the manufacture of patent leather. Their use is not, however, entirely restricted to the production of this one finish. Horse hides are finished in many ways similar to side-leather, and particularly the "shells," or quarters of the butt, constitute the only material from which real crup, or cordovan leather, can be made. A horse perspires through its skin, —which sheep, goats, and cattle do not,—and, therefore, its hide has a porous quality which many manufacturers consider advantageous from the point of view of ventilation. The shells are thicker and have a superior grain to the rest of the hide, for which reason they were prized even in mediaeval times. Cordovan leather remains today the most durable of all the upper leathers; its two disadvantages are its rather heavy stiff quality in contrast to calf-skin, and the fact that the threads of the seams of cordovan shoes are almost invariably cut in a short time by the hardness of the leather.

Cordovan

Kangaroo and Deer-skin

The skins of the Australian kangaroo yield a very fine, soft, light leather, similar to the best calf-skin, and are used to a certain extent in this country for high-grade shoes. Occasionally, also, one sees boot uppers made of various kinds of deer-skin, but much of the white leather known as "buck-skin" is made from the pelts of sheep.

Sheep-skin

There is probably no one animal from which such a variety of products are obtained as from the sheep. Besides mutton and wool, the sheep yields a pelt from which are made an extraordinary number of different kinds of leather. In the following chapters we shall see how some of the other leathers are produced, but for the moment we are concerned only with the manufacture of leather which goes into the making of shoes.

Sheep-skins usually come to the tanner after they have been dewooled at the pullery. This is sometimes done by sweating, but more often by a depilatory agent such as lime or sodium sulphate and sulphuric acid. Nevertheless, a secondary liming is given at the tannery in order that the short fibres may be completely removed. The latter operation, known as "cobbing," is similar to unhairing and is followed by fleshing.

Beam House

From this point the treatment of the skins varies, according to the kind of leather it is desired to make. The thickest skins are usually split into "skivers" (grain splits) and "linings" (flesh splits); skivers may then be tanned and finished for upper shoe leather, much the same as calf or goat skins. The splitting is done on a machine with an oscillating knife, which varies considerably from the hide splitter. The thinner skins are often finished for upper leather without splitting.

"Skivers" and "Linings"

The grain of sheep-skin is soft and particularly adapted to printing or embossing. Skivers are, therefore, the best possible material for artificial graining, and there are a great number of imitation grains produced on sheep-skin, which bear a very close resemblance to the original. Cheaper grades of suedes are also made by finishing sheep leather on the flesh side. The flesh-splits are not extensively used in making shoes, except for shoe linings and backings. We shall see in the next chapter, however, that they are used for a variety of other purposes.

Artificial Grains

Boarding the Grain

CHAPTER XIV

Oil Tannage of "Chamois" Leather

Many people today do not realize that the term "Chamois" has nothing but an historical meaning, at least when applied to the wash leather commonly known by that name. The species of Alpine goat from whose skin this leather was originally derived is practically extinct, and the article we know as "chamois" is made from the "lining" of a sheep-skin.

The very best quality of linings are usually made into parchment, but the vast majority are oil-tanned and used either for wash or glove leather. We have noted how the skins were split after coming out of lime. The next operation, so far as the linings are concerned, consists of removing the excess gelatinous matter by a machine similar to the flesher. This treatment, known as "frizing" is often used to remove the grain where the skin is too thin to be split. For cheaper grades of chamois the linings are sometimes re-split, instead of being frized.

"Frizing"

De-liming is then usually accomplished by means of an acid bath and a thorough rinsing in water, after which the linings are given a severe kneading in order to make them susceptible to the oil treatment. The necessary mechanical action is sometimes obtained by means of a drum-tumbler, but a particularly violent machine, known as the faller-stocks, is installed in most tanneries. The linings, having been thoroughly beaten and softened, are now hung to drain until they reach a sammed condition.

"Stocking"

The actual tannage consists in impregnating the raw material with animal oil and then allowing it to oxidize. Cod, whale, shark, and menhaden oils are the most commonly used in this country. The lining are placed flat in a vat, one at a time, and oil is poured over each. After remaining thus for a time they are again "stocked" so that the oil may penetrate thoroughly. Next they are oiled again as before, and re-stocked, the total number of oilings and stockings depending upon the individual tanner's ideas.

Oiling

Oxidation

The oxidation of the oil, and incidentally the real tanning of the leather, is now brought about by spontaneous heat, the linings being

placed in covered boxes and carefully watched. The oxidation is complete when no further heat is generated.

Finishing

Finishing wash leather consists first of thorough cleansing and drumming in fresh water. The uncombined oil is then pressed out, and the leather is hung to dry. The familiar processes of damping in sawdust and staking then follow, after which the leather is pared, smoothed with pumice on both sides, and stretched out for its final drying.

Pressing Sheep Skins

CHAPTER XV

Tawing Glove Leather

Suéde

Chamois leather, or thin chromed flesh splits are used for making suede gloves, but these, while exceedingly popular, are easily soiled and very difficult to clean. Most of the glove leather used is made by a different process and is finished on the grain side, although recent innovations have made the ooze or suede leather far more practicable than formerly.

Preparation for Grain Leather

Lamb and kid skins are the favorite raw material of the glove leather manufacturer, but light goat-skins and skivers are also extensively used. Europe, India, and Turkey furnish the best skins, quite a few of which are now being shipped pickled in barrels. After assorting the skins and soaking them to remove salt, most tanners apply a paste of lime and red arsenic to the flesh side. By this means the lamb's wool and kid hair, both of which are valuable, are loosened and easily removed either by machine or by hand. The skins are then usually soaked in lime liquor, fleshed, washed, trimmed, and severely bated. After they are taken out of the puer they are drenched in bran solution and scudded, before they are finally ready for the tawing process, which converts them to leather.

Tawing

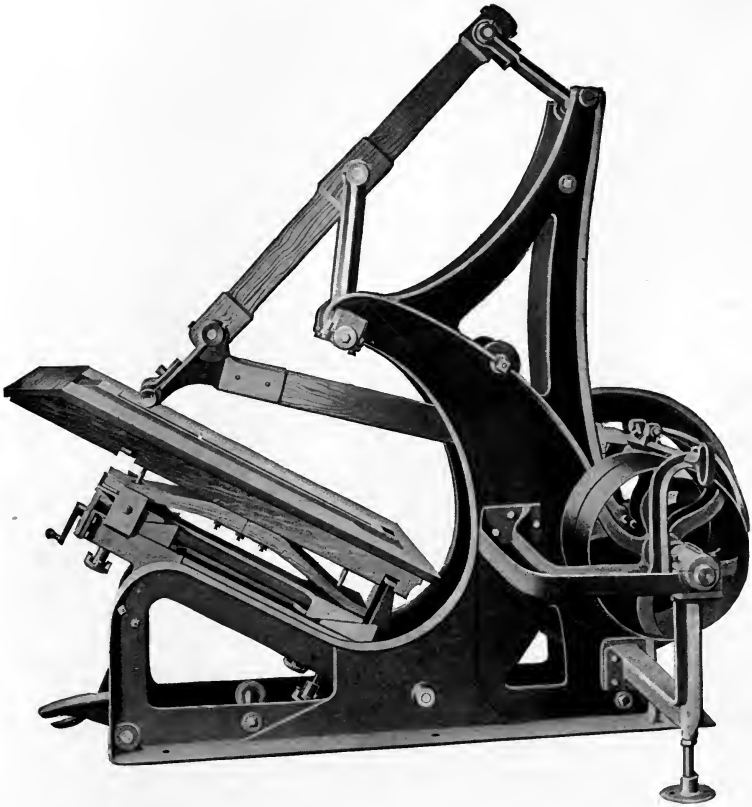
Alum or formaldehyde are the astringents which form the basis of almost all tawing liquors, a much used mixture being composed of: alum, egg-yolk, flour, salt and water. The process is usually carried out in a drum. A pure alum tannage results in stretchy leather which does not hold its shape and is not very warm, while formaldehyde will produce a soft, white, washable leather which lacks substance. Various combinations are therefore used to obtain a material which will satisfy in all respects.

Ageing

Drying, damping, staking, and sometimes shaving, follow, much as in the manufacture of chromed leather. After being staked the leather is dried at high temperature and allowed to "age" for several weeks. The latter is a very important feature characteristic of this particular industry.

Finishing

The next processes consist of dyeing, and fat-liquoring or re-tawing. Some glove leather, notably that tawed with formaldehyde, requires considerable filling in the fat-liquoring process. After staking, the grain is brushed, seasoned, glazed, and ironed, while the flesh side is pared and fluffed. There are a great many different methods of dyeing, which are highly interesting, but cannot be touched upon here, and there are almost as many finishes as there are glove leather tanners.



Glazing Machine

CHAPTER XVI

Book, Bag, and Upholstery Leather

Side leather splits and skivers are used for making book leather, but the best-known and most popular leather binding is that known as "Morocco." The latter was first made in Spain before the Middle Ages, and continues to be produced now by essentially the same process of tanning goat-skins in sumach liquor. The old method of "bottle tanning" consisted in sewing the skin into a bag inside out, leaving an opening at the neck, and filling it with the liquor, but this has now been supplanted by more modern devices such as paddle-vats and drums. The characteristic "grain" of Morocco is obtained by crushing and embossing it in various ways. India tanned goat-skins can be re-tanned in sumach, and when so treated, yield an inferior grade of Morocco.

"Morocco"

Most of the leather used for heavier bags and upholstery of furniture is made from "spready" hides. The latter are also extensively used for the manufacture of various grades of automobile upholstery, —which of recent years has become an item of considerable importance. The finest grades are made from the grain splits and go into the upholstery of high-priced automobiles, while the various flesh splits are finished into leather for medium and low-priced cars.

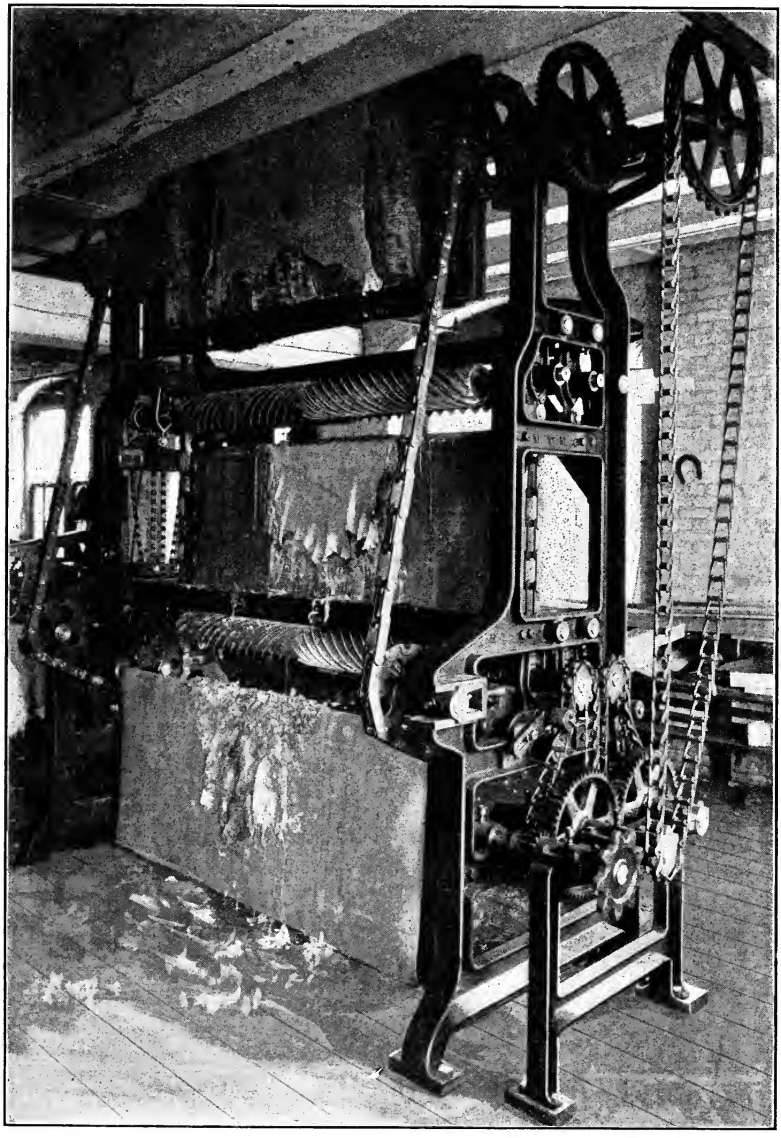
Upholstery

Some bag leather is produced by the chrome process, but most of it is still vegetable-tanned. The lighter bag leathers, such as those used for pocket-books and purses, are frequently made from skivers, which are particularly adapted for artificial graining. A great number of imitations of various rare leathers are made by embossing and printing on the grain of sheep-skins. Moreover, the bag and book-leather field is that which has been invaded the most successfully by manufacturers of various kinds of substitutes and imitation leathers made of other substances than the skins of animals.

Light Bag Leather

PART FOUR

THE ECONOMIC DISTRIBUTION OF THE INDUSTRY



Serial Table Unhairing Machine

CHAPTER XVII

The World's Supply of Raw Material

World's Animal Population

The available statistics in regard to the animal population of the world are so defective, particularly since the War, that it is possible to obtain only a very rough idea of the world's total supply and its distribution. It has been estimated that at the beginning of the War there were approximately 517,000,000 cattle and calves; 520,000,000 sheep; 155,000,000 goats; and 126,000,000 horses (including mules and asses in some countries). These figures are far from accurate, and particularly that for goats is probably much too low, owing to the fact that the supply in China is unknown. During the last year before the War the world consumed roughly 3,400,000,000 pounds of hides and skins, of which about one third was consumption of domestic raw stock in various countries, while two thirds was exported from raw stock producing countries to manufacturing countries.

Distribution

Estimates made by the United States Department of Agriculture since the outbreak of the War tend toward the conclusion that the world's supply of cattle, sheep, and goats is more or less stationary. The War has undoubtedly caused great wastage, but experience in the past has shown that the animal population of countries ravaged by warfare has recuperated remarkably fast. It would appear that the production of sheep has been falling off somewhat since 1907, while cattle have remained approximately the same, and the supply of goats is really an unknown factor. After-the-War estimates place the numbers of cattle in some of the leading producing countries as follows:

Cattle

India	129	million head
U. S. A.	66	
Russia	38	
Brazil	37	
Argentine	35	
Germany	25	
France	13	
U. K. of G. B.	12	
	355	leaving about 150 million unaccounted for.

Sheep and Goats

It would be impossible to attempt to show the distribution of goats, but the largest quantities are known to be in India, China, Russia, Turkey, and Mexico. As to sheep, a rough estimate would place the distribution about as follows:

Europe	150 millions
Australasia	98
Asia	97
South America	72
Africa	53
North America	52
	522

U. S. Cattle and Sheep

The cattle and sheep population of the United States since 1910 shows an increase of five million head of cattle and a decrease of seven and a half million sheep.

	Cattle	Sheep
1910	61,7 millions	52,4 millions
1911-15 avge.	58,0	51,4
1916	62,0	48,6
1917	64,5	47,6
1918	67,5	48,6
1919	68,4	48,8
1920	68,3	47,1
1921	66,1	45,0

The domestic production of hides and skins yields enough to supply our leather industry with about 55% *of its cattle hides,* 48% *of its calf-skins,* 30% *of its sheep-skins, and practically none of its goat-skins.* It is therefore quite evident that our tanners must obtain a large proportion of their raw material from such foreign countries as have a surplus for export.

CHAPTER XVIII

Imports of Raw Material into the U. S.

Before taking up the imports of hides and skins from a statistical point of view, it may be of interest to note a few particulars as to the methods whereby American tanners obtain their materials from foreign sources.

Frigorificos

By far the largest bulk of cattle hides imported into this country are derived from South American countries, as may be noted from the figures at the end of this chapter. The majority of these hides are "frigorificos" which are imported in a wet salted condition, chiefly from Argentina, Uruguay, and recently from Brazil. Several large tanners of heavy leather have their own purchasing agents in South America, who buy direct from the freezing plants, quite a number of which are controlled by American interests. Some of these representatives act as agents for several tanners, and also there are American brokerage houses which buy for account of various tanners. The largest Argentine hide brokers, on the other hand, maintain offices in New York and Boston and sell direct to the American manufacturers.

Other South Amer. Hides

Other South American hides, such as "saladeros" and "mataderos," as well as dried hides, are collected throughout the country by large native concerns, from whom the American buyer makes his purchases, although "saladeros" and "mataderos" are also bought direct by American brokers.

Oriental Hides

American buyers do not as a rule travel through the Far East. Asiatic hides, mostly dry, are collected by various native and European traders and sold by them to consumers in this country, or to American hide merchants. Indian and Javanese water-buffalo hides are becoming quite a large item for use in making cheap chrome sole.

Calf-skins

Europe has always been our chief foreign source of supply for calf-skins, the best grades coming from France and Scandinavia and the largest quantity from Russia. The latter source has been practically unavailable since the War, but imports from the rest of Europe are slowly getting back to normal. India supplies large quantities of cheaper grades of calf-skins and kips, which are purchased by American tanners through European or native merchants.

Sheep-skins

Before the War the Australasian sheep-skin business was handled through London, and American buyers used to contract for large supplies in that market. Most of this trade is now moving direct from Australia to this country, and there are quite a number of American buyers purchasing for tanners both in New Zealand and Australia. A considerable proportion of the South American sheep-skin business is controlled by American owned packing-plants, but there are also a very large number of native, French, British, and German houses in that market.

Goat-skins

A comparatively great number of American goat tanners are represented by purchasing agents in India and China, one agent frequently acting for several principals. The large importers of skins usually have their exclusive buyers.

The following figures, abstracted from the Department of Commerce trade reports will perhaps give a more complete view of the hide and skin imports.

(in even thousands)

	1918		1919		1920		1913	
	lbs.	$	lbs.	$	lbs.	$	lbs.	$
Buffalo Hides	5,818	1,547	15,620	3,463	9,484	2,721	16,234	2,790
Calf-skins	7,583	2,954	64,555	33,653	35,132	19,250	94,559	26,295
Cattle Hides	221,051	52,030	407,282	125,590	275,067	85,475	268,042	46,299
Goat-skins	62,364	30,490	133,657	95,557	80,205	88,693	96,250	24,790
Horse, colt, etc.	4,988	720	28,053	7,246	16,846	4,255	15,642	3,176
Sheep-skins	52,464	17,402	85,032	36,521	82,751	38,230	71,785	12,395
Kangaroo	679	733	1384	1,363	1,389	1,481	1,097	719
Other	6,933	2,168	9,256	3,116	9,110	3,828	4802	923
TOTAL	361,891	$108,044	744,836	$306,510	509,983	$243,934	568,411	$117,387

It is interesting to note from these figures how the first year after the War the imports in pounds more than doubled, and in dollars almost trebled, falling off both in pounds and dollars in 1920. A comparison with 1913 shows the difference still existing from pre-war times. The following tables will give the reader an idea of where the bulk of the imports come from.

Calf-skins

Out of about 4,285,000 calf-skins weighing *35,132,286* pounds, and costing $19,250,661.00 which were imported in 1920:

France supplied exactly	8,201,685 pounds
The rest of Europe, roughly	7,500,000 pounds
British India	4,980,902 pounds
Canada, Dutch East Indies, and the Argentine, (each roughly 2,700,000)	8,100,000 pounds
And the rest of the world about	7,000,000 pounds

Hides

Out of about 7,000,000 cattle hides weighing *275,066,507* pounds and imported during 1920 at a total cost of $85,475,324.00:

Argentine supplied	113,117,368 pounds
Canada	26,567,282 pounds
Uruguay	25,905,130 pounds
Brazil	19,488,355 pounds
Columbia	9,977,059 pounds
Other countries about	80,000,000 pounds

(Of the "other countries" India, Mexico, France, Cuba, Venezuela, and China follow in that order.)

Sheep-skins

About 35,200,000 sheep-skins, weighing *82,750,537* pounds, and costing $38,299,658.00 were imported in 1920. Of these

23,900,000 pounds came from Australia and New Zealand
13,680,000 pounds came from Argentina
11,950,000 pounds came from Canada
5,000,000 pounds came from British India
4,700,000 pounds came from British South Africa

The remaining skins came from various South American and European countries, with a few from Asia.

Goat-skins

Out of 47,000,000 goat-skins, weighing *80,204,607* pounds and costing $88,692,434.00, British India and China supplied by far the heaviest proportion

British India	28,310,320 pounds
China	19,061,548 pounds

About 10% of the total Hides and Skins imported into the country in 1920 were brought in through the Port of Boston, and of these 60% were financed by acceptances of The First National Bank of Boston. In other words this one bank financed 6% of the entire country's imports of hides and skins.

The Branch of The First National Bank of Boston in Buenos Aires finances a very large proportion of the hides and skins exported from Argentina.

Exports of Leather

Leather:	1918 Quantity	1918 Value	1919 Quantity	1919 Value	1920 Quantity	1920 Value	1913 Quantity	1913 Value
Belting . . . . . lbs.	. . . .	$2,097,877	. . . .	$4,241,260	192,867	$228,652	. . . .	$1,105,168
Carriage, automobile, and upholstery .	. . . .	163,541	. . . .	415,848	. . . .	740,477	. . . .	107,430
Glove	. . . .	2,908,890	. . . .	1,797,024	. . . .	2,198,759	. . . .	316,715
Patent . . . . . sq. ft.	. . . .	4,205,603	. . . .	18,480,619	21,693,810	17,643,464	. . . .	1,750,119
Sole . . . . . lbs.	26,748,035	14,164,982	122,660,993	54,871,639	22,429,639	11,983,902	36,630,167	8,804,955
Upper—								
Calf and Kip . . . . . sq. ft.	15,538,326	7,919,776	49,417,005	31,819,238	16,023,910	12,244,734	9,765,168	2,392,861
Goat and Kid . . . . . sq. ft.	24,335,031	9,728,323	104,377,890	57,920,607	54,911,165	35,240,181	106,080,203	19,573,509
Cattle sides . . . . . sq. ft.	7,028,084	1,868,435	50,481,517	11,531,143	. . . .	. . . .	. . . .	. . . .
Grain and finished splits . . . sq. ft.	. . . .	. . . .	. . . .	. . . .	16,524,554	6,995,033	. . . .	. . . .
Wax and rough splits . . . lbs.	. . . .	. . . .	. . . .	. . . .	5,042,100	1,940,711	. . . .	. . . .
All other upper	. . . .	8,076,984	. . . .	24,229,206	. . . .	12,166,975	. . . .	4,719,072
All other leather	. . . .	3,992,116	. . . .	13,476,716	. . . .	7,492,754	. . . .	3,614,370
Total leather . . .	. . . .	$55,126,527	. . . .	$218,783,300	. . . .	$108,875,642	. . . .	$42,385,199

Where Last Year's Export Went

1920 Sole Leather	Pounds	Value
Exported to—		
Belgium . . .	294,686	$212,236
Denmark . . .	1,253,905	874,277
France	458,159	248,253
Greece	289,814	241,515
Netherlands . . .	92,325	48,275
Norway . . .	455,411	293,722
Russia in Europe . .	387,771	209,227
Sweden . . .	1,581,013	848,804
Switzerland . . .	591,902	373,083
United Kingdom . .	8,060,178	3,964,984
Canada . . .	780,253	368,229
Newfoundland and Labrador .	208,135	159,462
Cuba	907,623	359,705
China	288,112	140,325
Japan	3,772,837	2,094,823
Russia in Asia . . .	1,402,855	701,639
New Zealand . . .	36,474	36,986
Philippine Islands . .	169,088	83,020
British South Africa . .	3,211	2,459
Other countries . .	1,295,887	722,878
		$11,983,902

1920 Upper Leather	Sq. feet	Value
Exported to—		
Belgium . . .	1,804,373	$1,166,070
Denmark . . .	7,762,847	4,818,120
France	3,169,942	2,239,028
Greece	581,888	470,244
Italy	1,692,793	1,400,551
Netherlands . . .	521,265	314,431
Norway . . .	434,903	333,306
Spain	234,005	137,374
Sweden . . .	1,387,931	1,189,303
United Kingdom . .	25,571,316	15,867,868
Canada . . .	2,604,737	1,480,682
Central America . .	1,356,077	691,254
Cuba	761,279	489,603
Argentina . . .	239,892	158,394
Brazil	797,296	489,692
Colombia . . .	641,947	395,670
Uruguay . . .	143,290	121,618
Japan	299,799	227,487
Australia . . .	315,321	314,632
Other countries . .	4,590,264	2,934,854
		$68,587,634

CHAPTER XIX

Exports of Leather from the U. S.

Whereas as we have seen the United States is dependent upon the rest of the world for about two fifths of its hides and skins, this situation is reversed when it comes to the finished product. Before the War this country controlled about 25% of the world's leather trade, but during the War this figure is estimated to have jumped for a time to about 70%. At the present time it is believed to have fallen off so that we may be said to do about one third of the world's business in leather. During the past year, however, largely due to unsettled conditions in Europe as evidenced by exchange rates, our exports of leather have fallen off in much larger proportion than our imports of hides and skins.

In order to become aware of the full significance of these figures it is necessary to study the quantity figures as well as the dollar amounts. Sole leather formerly constituted by far the most important export item, but has yielded both to patent and upper leather. The reason that the United States used to export so much sole leather to Europe was that the hemlock tree is found only in this country and Canada, and that hemlock tanned sole leather will hold hob-nails better than any other kind. Since the War England has been able to supply herself with sole leather because of the expansion undertaken during the period of hostilities. Furthermore, with exchange against us, and general conditions of such a nature that Europe is buying of us only things of the utmost necessity, it is easily comprehensible that the demand for hemlock sole from this country has fallen off.

Sole Leather

Although European production of sole leather was stimulated by the War, France and Germany, the greatest pre-war producers of high-grade upper leather, were unable to keep up their normal production. Accordingly the opportunity arose for American tanners not only to sell their upper leathers in Europe, but to capture great foreign fields such as South America as well. With Germany eliminated, American patent leather dominates the world's market, and glazed kid also is almost entirely an American product. How long this condition will last depends not so much upon the recuperation of Europe as upon

Upper Leather

the energy and intelligence with which the American tanners cater to their newly-won foreign trade.

Glove Leather

One of the most interesting results of the War, so far as our leather industry is concerned, was the surprising growth of the glove leather branch in this country. Before the War almost all our glove leather was imported, mostly from Germany, imports in 1913 amounting to $2,384,667. In spite of much higher prices per foot, the 1919 imports were only $789,098 and last year we actually exported $2,198,759.

CHAPTER XX

Marketing and Prices

Having now obtained a superficial view of the raw material, the various processes of manufacture, and lastly of the relative position of the United States in this industry, it remains only to show briefly in what manner the raw and finished products are bought and sold, and how the prices of both fluctuate.

Marketing Hides

Hides, as we have seen, come primarily from the North and South American meat-packing establishments. Many of these packers are affiliated with sole leather tanneries to which they sell their hides direct, and a great many large independent users of hides send their buyers to Chicago and even to Buenos Aires. Hides other than "Packers" or "Frigorificos" are more frequently collected by hide merchants who in turn sell to the tanners.

Skins

Domestic calf and sheep-skins are frequently sold direct by the killer to the tanner, but imported calf, goat and sheep-skins are often brought into the country by merchants and brokers. The largest tanners, however, send out their own buyers to foreign countries.

Sole Leather

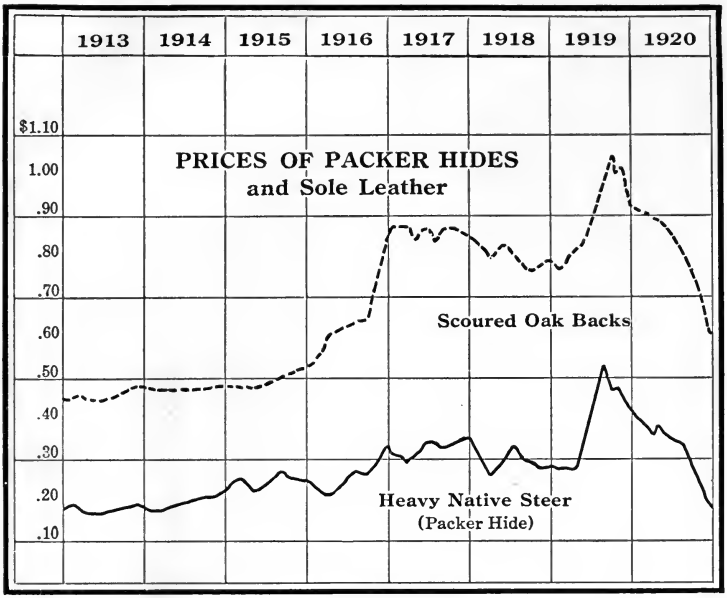
Sole leather is sold, as we have previously noted, on a basis of cents per pound, while upper leather prices are per square foot. Sole leather, moreover, is sold according to tannage (oak, hemlock, union, etc.), and according to what section of the hide it consists of (backs, bends, shoulders, bellies, heads). A great deal depends upon how the leather is trimmed, it being a custom, for instance, to trim bends for shoe-manufacturers wide, while those for the repair trade are cropped close. Sole leather is usually sold by the tanner's own selling organization to the shoe-manufacturers and sole-cutters, although some finds its way into consumption through the hands of sole leather dealers.

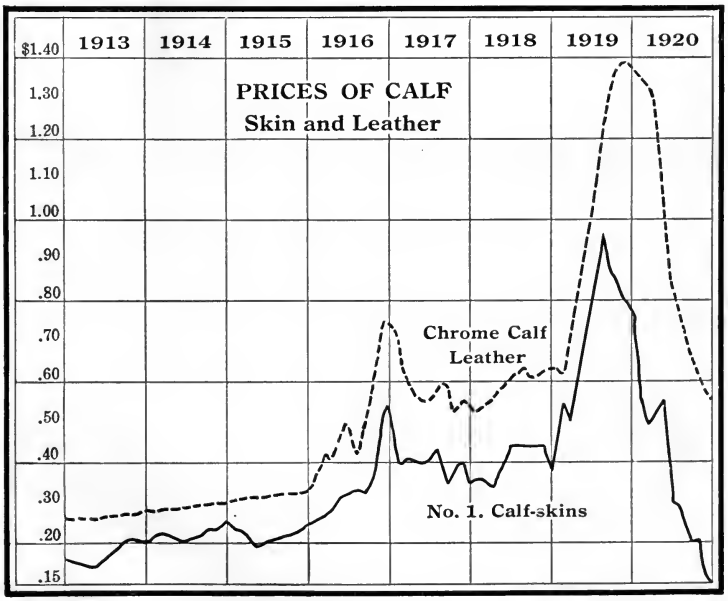
There is a distinct contrast between the sole and upper leather trades from the point of view of organization. The comparatively heavy investment and slow turn-over of the sole leather manufacturer have tended to concentrate this business in the hands of a few large concerns, while the opposite conditions have caused a greater distribution in the manufacture of light leathers. Moreover, upper leather is sold at a certain price per foot for each grade and finish, no difference being

made for different sections of the skin. Since there are a considerable number of small tanners it is natural that much more of their product should pass through the hands of dealers and commission houses before reaching the manufacturer.

Prices

The fluctuation of prices presents a most interesting field for study, particularly during the last five years, but it is not possible, within the confines of this booklet, to do more than indicate what the general trend has been. The accompanying graphs show the course of hide and sole leather prices, and calf-skin and calf leather from 1913 to the end of 1920. Comment upon them is unnecessary except to point out that the first quarter of 1921 has witnessed an even further decline which would bring all four curves substantially down to or below their levels at the beginning of 1913. Prognostications are always dangerous, but it is safe to say that a moderate recovery cannot be far distant. Whether the level of stabilization will be substantially above that of 1913-1914 is a matter of conjecture, depending, as do all things pertaining to the economic future, upon the adjustment in Europe.





Price Fluctuation

SIX SALIENT POINTS ABOUT

THE FIRST NATIONAL BANK OF BOSTON

AND THE

SHOE AND LEATHER INDUSTRIES

1. *The Five Largest Domestic Producers of Raw Hides and Skins* are customers of *The First National Bank of Boston.*

2. 6% of all the *Hides and Skins Imported* into the country in 1920 were financed *by Acceptances of the First National Bank of Boston,* without taking account of imports indirectly financed by this bank through loans to importers and tanners.

3. Out of about *750 Leather Manufacturers* in the country
   24% *are in New England*
   10% *are Customers of The First National Bank of Boston.*

4. Out of about *1300 Shoe Manufacturers* in the country
   45% *are in Massachusetts*
   10% *are Customers of The First National Bank of Boston.*

5. 85% of all the leather-working and shoe-manufacturing machinery used in the country *is made by customers of The First National Bank of Boston.*

6. Besides this there are hundreds of merchants, dealers, jobbers, brokers, wholesalers, and retailers of shoes and leather or manufacturing supplies, who maintain their accounts at this institution.

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